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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

The Development of General and Physical Chemistry in the last Forty Years. WALTHER NERNST (*Ber.*, 1907, 40, 4617—4626).—A lecture delivered before the German Chemical Society. W. H. G.

Refractometric Researches. JOHAN F. EYKMAN (*Chem. Zentr.*, 1907, ii, 1205—1211; from *Chem. Weekblad*, 1906, 3, 653—662, 685—693, 701—715; 1907, 4, 41—52).—In previous papers (Abstr., 1893, ii, 1; 1894, ii, 173; 1895, ii, 33, 65; 1896, ii, 133; 1897, ii, 1), it has been shown (1) that the molecular dispersion and refraction of atoms and groups of atoms in different compounds can only be regarded as constant if such atoms or groups exert identical functions in the compounds; (2) that the constants for the atoms and groups, and even for the CH_2 increment of homologous series, have not yet been determined with sufficient accuracy, and (3) that it is not possible to find a simple general formula which will render the molecular refractions and dispersions independent of the temperature, and that the Lorenz formula gives the least useful results.

In the present paper, the author deals with (*a*) the refraction of homologous compounds for different rays of the visible spectrum; (*b*) with the applicability of Cauchy's formula; (*c*) with the relation of the dispersion quotients; (*d*) with the influence of ring formation and (*e*) of the double carbon linking on dispersion and refraction.

The values of n for the hydrocarbons C_8H_{18} and $C_{32}H_{66}$ for the α, β, and γ hydrogen rays have been determined, and from them the molecular refractions have been calculated by the formulæ and corrections of Gladstone and Dale, Lorenz, and Eykman. By subtracting the values found for C_8H_{18} from those found for $C_{32}H_{66}$, and dividing the difference by 24, the following molecular refractions for CH_2 were obtained for red light, *r*: 7·7664 (G. and D.), 4·6101 (L.), 10·253 (E.). The dispersions, also measured from *r*, were for α, +0·0053; β, +0·1443; γ +0·2238 (G. and D.); α, 0·0031; β, 0·0750; γ, 0·1156 (L.); and α, 0·007; β, 0·179; γ, 0·278 (E.). Starting from octane, by means of these values the corresponding values have been calculated for the two hydrogen atoms at the ends of the chain: *r*, 2·143; α, 2·144; β, 2·158; γ, 2·172 (G. and D.); *r*, 2·121; α, 2·120; β, 2·148; γ, 2·170 (L.); and *r*, 3·727; α, 3·726; β, 3·759; γ, 3·792 (E.); or, starting from methane, 2·12 (G. and D.), 2·0 (L.), and 3·85 (E.).

The constants calculated by means of Cauchy's formula are in good agreement with those found in the region $\gamma - r$. According, however, to the degree in which constitutional functions appear in a compound which abnormally increase the dispersion, Cauchy's formula is more or less inapplicable. The ratio $H_{\beta-\alpha} : H_{\gamma-\alpha}$ according to this formula is 1 : 1·563. The ratio found for CH_2 is 1 : 1·572, whereas in the case of ethyl *p*-methoxycinnamate it is 1 : 1·786, and in that of ethyl cinnamenylacrylate is 1 : 1·828. As the dispersion quotients vary from the normal, so are the molecular refractions abnormally increased and differ from the values calculated from the so-called atomic constants. Since the cause of this variation lies in differences of constitution, it follows that the comparison of different compounds by means of mean atomic refraction values has but little significance.

Contrary to Brühl's opinion, the increment for double linkings is not constant. A comparison of the optical values for *cyclo*pentane, *cyclo*hexane, *dicyclo*nonane, and *tricyclo*decane with those of the corresponding paraffin hydrocarbons (C_5—C_{10}) (calculated from octane) shows that, in consequence of ring formation with elimination of H_2, the increase of refraction for each of several ring formations is nearly the same for each H_2. The mean values found were 3·03 (G. and D.), 2·20 (L.), and 4·41 (E.), which, with the exception of that calculated by the Lorenz formula, vary considerably from the values for H_2 already given, and from the values for free H_2, 3·09 (G. and D.), 2·06 (L.), 4·40 (E.), markedly in the case of (L.), and scarcely at all in that of (E.). Ring formation in the cyclic hydrocarbons does not increase the dispersion.

The optical values of a large number of compounds have been determined in order to study the points referred to, and the results are recorded. Variations from the normal values are explained by consideration of the constitution of the different compounds.

E. G.

Magnetic Double Refraction of Organic Liquids. A. Cotton, Henri Mouton, and P. Weiss (*Compt. rend.*, 1907, **145**, 870—872).—The magnetic double refraction of organic liquids which are active in this respect (Abstr., 1907, ii, 727) varies directly with the square of the strength of the magnetic field. Nitrobenzene exhibits the phenomenon to a more marked extent than any of the other liquids, and, by employing a great thickness of liquid, the angle measuring the double refraction of this compound exceeds 6°; the corresponding values for benzene and carbon disulphide under the same conditions are 0·24 and −0·19 respectively of that of nitrobenzene. M. A. W.

Apparatus for the Production of Spark Spectra of Solutions. Comte ANTOINE DE GRAMONT (*Compt. rend.*, 1907, **145**, 1170—1173).—The author has designed an apparatus by means of which the spark spectrum of solutions can be obtained free from lines due to the gold, platinum or graphite electrodes, or to impurities present in the glass. The method consists in passing the spark between two drops of the liquid fed by two capillary silica tubes inclined at an angle of 45°, which also carry the platinum electrodes. For details of the method, as also for a sketch of the apparatus, the original must be consulted. M. A. W.

Gradual Modification of the First Linear Spectrum of Emission of Mercury. ENRICO CASTELLI (*Phil. Mag.*, 1907, [vi], **14**, 784—785).—In taking spectrophotographs of the electric arc in the vapour of mercury in a Uviol lamp, it has been observed that the spectrum lines, whilst remaining constant in position, gradually show a variation in their photochemical action, the lines corresponding with the less refrangible, monochromatic rays producing an increasing, those corresponding with the more refrangible rays a decreasing, effect on orthochromatic plates. Thus the photographic impression of the three lines, of the wave-lengths 3663·3, 3654·9, and 3650·3 Ångström units, nearly completely vanished, whilst that of the lines 5790·49, 5769·45, and 5460·97, which at first were scarcely visible, became the most intense. This change must be ascribed to an alteration in the character of the positive univalent ions, which renders oscillations of higher frequency impossible, but favours vibrations of less wave-length. G. Y.

Use of very low Temperatures for Spectrum Analysis, and for the Study of the Magneto-optical Phenomena of Solutions. JEAN BECQUEREL (*Compt. rend.*, 1907, **145**, 1150—1153).—The author has extended the study of the effect of low temperatures on the absorption bands of solids (*ibid.*, **144**, 420, 1032, 1336) to the case of solidified solutions with similar results. The large band observed in alcoholic solutions of the nitrates of didymium, neodymium, erbium, or samarium at 20° becomes separated into numerous components, frequently of great clearness and intensity, at −188°. In the case of neodymium nitrate, certain bands show a very slight diminution in wave-length as the concentration of the solution increases, and the groups of bands afforded by equivalent methyl- and ethyl-alcoholic solutions of this salt are very different.

The absorption spectra of solutions at the temperature of liquid air are modified similarly to those of crystals in a magnetic field (compare Abstr., 1906, ii, 317; 1907, ii, 147). M. A. W.

Artificial Dichroism of Blue Rock Salt. H. Siedentopf (*Ber. deut. phys. Ges.*, 1907, 5, 621—623).—When blue rock salt is subjected to pressure at right angles to a hexahedron surface, it exhibits dichroism. This phenomenon is confined to blue and violet colorations of sodium chloride, but always makes its appearance in these cases whether the coloration is of natural or artificial origin. The artificial coloration may be effected by the action of cathode rays.

J. C. P.

Dependence of Colour on Temperature, and the Importance of this Phenomenon for the Theory of Colours and of Radiation. W. J. Kurbatoff (*Chem. Zeit.*, 1907, 31, 1169).—The effect of change of temperature on the colour of about three hundred and fifty substances, both in the solid state and in solution, has been investigated. It is found that the decrease in colour intensity, produced by lowering the temperature, is most marked with substances having a greenish-yellow colour, much less with yellow, orange, red, and purple substances, whilst the change with violet substances is hardly perceptible. The effect produced by the change of temperature is attributed to an alteration in the rate with which various atoms or radicles in the molecule unite and disunite. W. H. G.

Decoloration of Pigments in the Visible Spectrum. P. P. Lazareff (*J. Russ. Phys. Chem. Soc.* [*Phys. Part*], 1907, 39, 236—246).—The aim of the research was to trace the connexion existing between the process of decoloration and the optical properties of pigments in the visible spectrum, and to deduce the quantitative relation between the amount of substance decomposed and the wave-length and energy of the incident light. Experiments were made with cyanin, lepidinecyanin, pinacyanol, pinaverdol, quinaldinecyanin, and pinachrome in the form of thin layers of collodion impregnated with the dye, which were decolorised in the region of the absorption bands, but in no other part of the spectrum. An apparatus is described for investigating photometrically various parts of the coloured plate when under the influence of the rays which produce coloration. In this way, the energy absorbed by the plate, as also the amount of substance decomposed, can be estimated, and the following relations are deduced: $\Delta c/c = (\log J_2 - \log J_1)/(\log J_0 - \log J_1)$ and $Q = E[1 - (J_1 + J_2)/2J_0]\Delta t$ (where c = the concentration of the pigment; Δc, the change in concentration in the time, Δt; J_0, J_1, J_2, the relative intensities of the two fields of the spectrophotometer; J_0, without a coloured plate; J_1, when a coloured plate is first inserted; J_2, after an interval, Δt; Q, the energy absorbed during Δt; E, the energy falling on the plate). Only a small fraction of E is used for producing the photochemical reaction, most of it only serving to heat the absorbing layer. Curves are drawn showing that, in the region of the absorption bands, the amount of substance decomposed is proportional to the energy absorbed, and is independent of the wave-length and intensity of the incident light.

Z. K.

Protochemical Reactions. II. Gaseous Reactions which are Photochemically Sensitised. A Theory of the Catalytic Influence of Light. FRITZ WEIGERT (*Ann. Physik.*, 1907, [iv], **24**, 243—266. Compare Abstr., 1907, ii, 835).—When gaseous systems containing chlorine are exposed to light, molecular complexes are probably produced, which act catalytically as reaction nuclei. At these nuclei, it may be supposed, equilibrium between the reacting gases is established with such rapidity that the further progress of the reaction is conditioned by the rate of diffusion to these nuclei of the remaining portions of the gases. According to this theory, therefore, photochemical reactions may be brought under the category of heterogeneous reactions.

Experimental evidence is brought forward showing that when chlorine is exposed to ultraviolet, violet, or blue light, the production of fog may actually be observed (compare Bevan, Abstr., 1904, ii, 21; Burgess and Chapman, Trans., 1906, **89**, 1423).

If the author's view is correct, then reactions which are not themselves affected by light should be catalytically affected by the presence of the reaction nuclei already mentioned. In this connexion, it is shown that the formation of water, the formation of sulphur trioxide, the dissociation of carbonyl chloride, the decomposition of ozone, the Deacon chlorine process, and the formation of ammonia from its elements are reactions which, although not themselves sensitive to light, may be sensitised, that is, catalytically accelerated, by adding chlorine and exposing to light.

The same hypothesis of the formation of reaction nuclei may be extended to solutions, and special reference is made to Kistiakowsky's observations (Abstr., 1901, ii, 58).

The fact that all photochemical reactions yet studied are unimolecular, and the fact that the temperature-coefficient of these reactions is of the same order as the temperature-coefficient of a diffusion process, are regarded as lending support to the conception of photochemical reactions as heterogeneous catalytic reactions. The fact that the activity of chlorine and other substances sensitive to light does not cease immediately when exposure is stopped, is also in favour of the foregoing view that definite nuclei are produced. J. C. P.

The Absolute Distribution of Intensity in the Continuous Background of the Spectra of the Alkali Metals; the Radiation of the Hefner Lamp and of Osmium. F. LEDER (*Ann. Physik.*, 1907, [iv], **24**, 305—325).—Photometric measurements of the continuous background of the spectra of the alkali metals by means of a spectrophotometer. The radiations of the Hefner lamp and the 36-volt osmium lamp used as the lights for comparison were also investigated. J. C. P.

Fluorescence and Chemical Constitution. HUGO KAUFFMANN (*Ber.*, 1907, **40**, 4547—4555. Largely polemical in reply to Hantzsch, Abstr., 1907, ii, 834).—The author states that potassium quinoldisulphonate fluoresces even in the purest water, and describes a simple apparatus for observing fluorescence. The fluorescence observed with alkaline solutions of the potassium salt is not due to oxidation, as the same phenomenon is observed in an atmosphere of hydrogen and in sodium carbonate solution. The intensity of the fluorescence decreases with rise of temperature, but is again restored as the solution cools; the operations may be repeated indefinitely with the same results. The fluorescence is not due to impurities, as the salt when prepared by different methods and repeatedly purified still fluoresces. The potassium salts of the sulphonic acids derived from *p*-aminophenol and *p*-phenylenediamine also fluoresce. J. J. S.

Production and Origin of Radium. Ernest Rutherford (*Phil. Mag.*, 1907, [vi], 14, 733—749).—An account is given of previous investigations on the genesis of radium, and a number of new experiments are described. It is now found that over the period of observation (three hundred and five days), radium is formed in actinium preparations at a constant rate. This rate diminishes as the actinium is purified by repeated solution in hydrochloric acid and precipitation with ammonium sulphide, and finally with ammonia, whereby both radium and actinium-*X* are removed, until a preparation is obtained which produces radium extremely slowly, if at all. The active deposit of actinium-*A* and -*B* was concentrated on a platinum plate by keeping this negatively charged in presence of the emanation from an active, solid actinium preparation. After fourteen days, the platinum plate was placed in hydrochloric acid and tested for radium, which was not found in measurable amount, and was certainly less than 1/180 of the amount to be expected if actinium-*B* changed directly into radium. This result, which is in agreement with the constant rate of growth of radium in an actinium solution freed from actinium-*X*, shows conclusively that actinium-*B* does not change directly into radium, but does not exclude the possibility of the existence of a slowly changing product between actinium-*B* and radium.

The results indicate that in ordinary actinium preparations there exists a new substance which is transformed slowly into radium and can be separated chemically both from radium and actinium, since the actinium precipitated by ammonium sulphide contains this parent of radium in excess over the normal, but the filtrate from which the remainder of the actinium may be precipitated by adding ammonia does not contain it even in traces. The observations have not extended over sufficient time to determine if this parent of radium has or has not any direct genetic connexion with actinium.

G. Y.

Certain Properties of the Radium Atom. Eduard Riecke (*Chem. Zentr.*, 1907, ii, 1221—1222; from *Nachr. K. Ges. Wiss. Göttingen*, 1907, 162—170).—The disintegration constants of radium can be calculated by three different methods: (1) from the volume of the emanation evolved per second from 1 gram of radium; (2) from the amount of heat developed, and (3) from the quantity of electricity given off in the form of β-rays. Calculating by the first method, Ramsay's determinations lead to the value one thousand and forty years for the average life of a radium atom, whilst by the second method, Precht's measurements indicate a period of one thousand five hundred and ninety years. The third method, however, according to Wien's determinations, leads to a quite different and probably untrustworthy value.

The amount of energy contained in the radium atom is discussed, and, from the assumption that the atom consists of positive ions and negative electrons, the deduction is made that the energy liberated on disintegration was formerly present in the atom as potential energy.

E. G.

Amount of Radium Emanation in the Atmosphere near the Earth's Surface. A. S. Eve (*Phil. Mag.*, 1907, [vi], **14**, 724—733).—The radium emanation in the atmosphere near the earth's surface is measured by passing a known volume of air through cocoanut charcoal, which is afterwards heated, the absorbed emanation being driven over into an electroscope. The absorption of the emanation is complete only if the current of air is extremely slow, but in faster currents the charcoal absorbs the same fraction of the emanation at any given velocity. Hence, the air is passed through the absorption tubes at a convenient rate, and the results obtained compared with those from air which has first been passed through a solution containing a known amount of radium. Four determinations were made in Montreal at different seasons of the year, and the results are given in terms of the amount of radium required to maintain the supply of emanation per cubic metre constant. The smallest value obtained was 24×10^{-12}; the largest 127×10^{-21}. The probable average value is 80×10^{-12}. The amount of emanation is of the correct order to account for the active deposits of radium-*C*, which may be collected from the atmosphere on negatively charged wires.

G. Y.

Condensation of Water Vapour in the Presence of Radium Emanation. Madame Marie Curie (*Compt. rend.*, 1907, **145**, 1145—1147).—The apparent gravitation of the induced radioactivity suspended in a moist gas containing radium emanation (Abstr., 1907, ii, 728) is due to the condensation of the water vapour on the particles of the induced radioactivity, with the formation of a mist, invisible in ordinary light, but visible in the light of the electric arc. The experiments were conducted in small flasks of 35 to 50 c.c. capacity, containing the maximum emanation from a solution of 0·05 gram of radium chloride. In the case when the air in the flask was saturated with water vapour, the initially opaque mist gradually changed into larger drops, and was perceptible after twenty days; for a pressure of water vapour of half the preceding value, the mist persisted for ten days, and a visible mist was also produced when the pressure of the water vapour was reduced to that of 1 cm. of mercury. When, however, the air in the flask was dried by means of phosphoric oxide, no mist was formed by the dry emanation, but the introduction of light petroleum into such a flask led to the formation of a mist of greater intensity than that produced in air saturated with water vapour. When a difference of potential is established between two platinum electrodes in a flask containing radium emanation and air saturated with water vapour, the mist rapidly disappears, but forms again when the electric field is suppressed. These results show that it is the particles of induced radioactivity (radium-*A*) and not the emanation molecules that form the nuclei for the condensation of the water vapour, since the former particles move rapidly towards the cathode in an electric field, whilst the latter do not suffer any appreciable movement.

M. A. W.

Action of Radium Bromide on Precious Stones of the Family of Aluminides. FRÉD. BORDAS (*Compt. rend.*, 1907, **145**, 800—801. Compare Abstr., 1907, ii, 956).—By bringing a tube of radium bromide of very high activity (1,800,000) into direct contact with a corundum, and varying its position every few hours, the coloration can be effected evenly in some days. Darkness is not necessary for the action, which proceeds in daylight. Colourless corundums can be rendered yellow, and the colour of natural topazes and faintly coloured rubies intensified in colour. Artificial rubies are similarly effected. The emanation is inactive. When a colourless corundum in contact with 0·001 gram of radium bromide of high activity, contained in a glass tube, is immersed in liquid nitrogen, it becomes yellow at the end of several days. It is therefore improbable, since potassium is not oxidised by liquid oxygen, that the coloration is due to oxidation of the trace of foreign metallic oxide in the corundum.

E. H.

Coloration of Certain Precious Stones under Radioactive Influences. DANIEL BERTHELOT (*Compt. rend.*, 1907, **145**, 818—820. Compare Marcellin Berthelot, Abstr., 1906, ii, 863).—Specimens of certain minerals, placed by Marcellin Berthelot in November, 1906, in the neighbourhood of radiferous barium chloride, were examined in October, 1907, and found to have undergone the following changes. A colourless quartz from la Gardette and a white, cleavable fluorspar were unchanged. A violet, amethystine quartz (containing manganese) from Uraguay, which had been previously decolorised by heating, was re-coloured, and a violet fluorspar from Weardale (Durham) had behaved similarly. The above white, cleavable fluorspar, after soaking in a saturated solution of manganese acetate, becomes faintly rose-coloured in the interior when exposed to radium; the colourless quartz does not exhibit this phenomenon. A green emerald from the Tyrol, decolorised by heating and left in the evolved vapour, when exposed to radium is unchanged, as is also a natural, white emerald. Saturated solutions of manganese acetate and chloride are not changed by radium. The latter experiment disproves the hypothesis which attributes the coloration of glass under the influence of radium to the existence in it of the metal as ions, their discharge by the β-rays, and precipitation of the metal in a finely-divided state. If crystals of potassium sulphate which are coloured by radium radiations are heated to redness, the coloration is no longer produced, probably owing to the destruction of organic impurities as in the case of emeralds. Moreover, some small crystals of potassium sulphate, which had become green after exposure in an india-rubber tube to the action of radium, were decolorised by washing with chloroform, and the latter on evaporation left a green residue.

E. H.

Action of Röntgen Rays on Corundum. FRÉD. BORDAS (*Compt. rend.*, 1907, **145**, 874—875).—The coloration of crystallised alumina by exposure to radium bromide (Abstr., 1907, ii, 956; preceding page) is not due to the action of the α-rays, since these were absorbed by the glass envelope containing the bromide. In the present paper, it is shown that the γ-rays are operative in this respect, for colourless corundum becomes distinctly yellow after forty minutes, and topaz coloured after several hours' exposure to the action the Röntgen rays, and these rays are analogous to the γ-rays of radium. M. A. W.

Radioactivity of Vesuvian Cotunnite. PAOLO ROSSI (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 630—638. Compare Zambonini, Abstr., 1907, ii, 663).—Vesuvian cotunnite does not contain radium in appreciable proportion, the substances which render it active being those which cause the so-called induced activity of radium, namely, radium-*D*, radium-*E*, and radium-*F*. That this is the case is shown by the laws governing both the re-activation and the diminution of the β-activity due to radium-*E*, and is confirmed by the separation of polonium by the ordinary methods. A difference is observed between the law of increase of activity of a preparation rendered inactive and that according to which the activity tends to disappear when the radium-*D* substance is separated; this is explained by assuming that radium-*E* is composed of two succeeding compounds in the series of transformations, the second only of these being endowed with β-activity. That other radioactive substances do not seem to accompany cotunnite is shown by the absence of uranium and of emanation, and the corresponding induced activity. T. H. P.

Radioactivity of the Kissingen Mineral Springs. FELIX JENTZSCH (*Physikal. Zeitsch.*, 1907, **8**, 887—890).—The radioactivity of the waters from the Pandur, Max, Rakoczy, Saline, and Schönborn springs and of the deposits from the last three has been measured at the respective sources.

Air which has been bubbled through the first three spring waters contains a large quantity of a rapidly decaying emanation (thorium emanation?). The induced activity has a decay curve which closely resembles that of the induced thorium activity. These facts point to the presence of thorium salts in the springs. The decay curves of the induced activity from the Saline and Schönborn sedimentary deposits closely resemble the decay curve of radium. H. M. D.

The Lithium contained in Radioactive Minerals. Mlle. ELLEN GLEDITSCH (*Compt. rend.*, 1907, **145**, 1148).—The transformation of copper into lithium by radium emanation, observed by Cameron and Sir William Ramsay (Trans., 1907, **91**, 1593), has led the author, at Madame Curie's suggestion, to investigate radioactive minerals for the presence of copper and lithium, and to determine, if possible, the ratio between the quantities of the two elements when present. In this preliminary note, the result of an examination of Joachimsthal pitchblende is given; the mineral contains a small quantity of lithium (compare McCoy, *Nature*, Nov. 28th, 1907), the residue containing the alkali metals showing a feeble, although distinct, red lithium line when examined spectroscopically. M. A. W.

Lancien's Radioactive Molybdenum Compound. Aurel von Bartal (*Chem. Zeit.*, 1907, **31**, 1156—1157. Compare Lancien, Abstr., 1907, ii, 697).—The author's results are in agreement with those of Szilárd (Abstr., 1907, ii, 731) and Wedekind (*ibid.*, 922).
W. H. G.

Electric Arc between Metal Electrodes. W. G. Cady and H. D. Arnold (*Physikal. Zeitsch.*, 1907, **8**, 890—906).—The phenomena accompanying the transition from the glow to the arc discharge between electrodes of different metals have been examined. The character of the discharge between iron electrodes in air changes completely when the strength of the current reaches a certain value. With electrodes of 3—6 mm. diameter, the "critical point" corresponds with a current of about 1 ampere. The condition of the discharge with lower currents than this is called the "first stage," that with higher currents the "second stage," of the discharge. Measurements of the loss of weight of the electrodes as well as spectroscopic and thermoelectric observations indicate that, in the "first stage," the anode is not volatilised. The existence of two stages, separated by a critical point, has also been observed in the discharge between copper electrodes in air, and between a carbon cathode and anodes of lead, silver, and carbon in nitrogen under diminished pressures. With anodes of aluminium, zinc, mercury, cadmium, and tin, no indications of the "first stage" were obtainable, and with a bismuth anode the "first stage," although it appears to exist, was too unstable for measurements to be taken. A stable "first stage" was also not obtainable with platinum or iron electrodes when oxygen had been completely removed from the system.

The transition through the "critical point" is accompanied by a fall of potential between the electrodes, and this is ascribed partly to a decrease in opposing thermoelectric force at the anode and partly to the increased conductivity of the vapours in the arc discharge.

With an arc discharge of somewhat less than two amperes between iron electrodes, rotation of the positive end of the arc takes place, this being accompanied by the emission of a whistling sound, which, on increasing the current, gradually passes into a hissing sound, when the rotation ceases. Lecher's observations relating to the continuity of the discharge have been confirmed for high current discharges. Whilst, however, the "first stage" discharge between iron electrodes is continuous, that between silver and copper anodes and a carbon cathode exhibits very definite alternations. H. M. D.

Experimental Investigation of the High Tension Arc. Brion (*Zeitsch. Elektrochem.*, 1907, **13**, 761—786).—The arc studied was produced between two short cylindrical electrodes having a common, vertical axis. The arc was thus horizontal. A magnetic field at right angles to the direction of the electric current in the arc was produced by means of a solenoid surrounding the electrodes, the arc was thus caused to rotate in a horizontal plane, producing a thin disc of white-hot gas between the electrodes. The whole arrangement was enclosed in a chamber, the walls of which were made of bad conductors of heat, and air was passed upwards through the arc. The electrical properties of the arc were first studied in considerable detail, both with direct and alternating currents. The *E.M.F.* (between the electrodes) required to produce a steady arc is greater the smaller the current. In general, anything which raises the temperature of the electrodes or of the gas between them diminishes the *E.M.F.* required. The *E.M.F.* required with alternating current is greater than with continuous current. Arcs with small current are much less stable than those with larger currents. A large number of experiments were made on the yield of nitric oxide obtained with the rotating arc. Continuous and direct current arcs gave practically the same results; when the velocity of the air was reduced so as to raise the quantity of nitric oxide above about 1·5%, the yield began to diminish. Increasing the diameter of the outer electrode from 16 to 24 cm. increased the yield by about one-fifth. Small currents and strong magnetic fields appear to improve the yield slightly; different methods of surrounding the electrodes had no noticeable effect. The best yields obtained were 57 to 58 grams of nitric acid per kilowatt hour. T. E.

Action of an Incandescent Electric Conductor on the Surrounding Gas. H. COURIOT and JEAN MEUNIER (*Compt. rend.*, 1907, **145**, 1161—1163).—The authors have shown previously (Abstr., 1898, i, 545; *Compt. rend.*, 1898, **127**, 559) that an inflammable mixture of methane and air is not ignited by an incandescent filament or wire unless the wire fuses and a spark is produced. In explanation of this phenomenon, it is suggested that the incandescent filament attracts the oxygen molecules and repels those of the hydrocarbon in the mixture; the zone of gas therefore surrounding the filament is too poor in the hydrocarbon to be inflammable, and slow or rapid combustion occurs with the formation of water and carbon dioxide (Abstr., 1898, i, 545). When, however, the filament employed is sufficiently voluminous to raise by radiation the temperature of the inflammable mixture beyond the inert zone to about 650°, an explosion occurs, and Hauser has shown recently that, whilst an incandescent ferro-nickel wire 0·3 mm. diameter does not ignite a mixture of air and 9% of methane, a soft iron wire 0·9 mm. diameter caused an explosion in six out of seventeen times. M. A. W.

Cathode Potential Fall and Spectra in some Compound Gases. GEORG GEHLHOFF (*Ann. Physik*, 1907, [iv], **24**, 553—578).—When a current of a compound gas is passed continuously through a Geissler tube, it is possible to eliminate the influence of the decomposition and to obtain a constant discharge. It is possible also in this way to obtain spectra of such compound gases as are too rapidly decomposed in a closed Geissler tube. The gases investigated by the author were ammonia, carbon monoxide, carbon dioxide, methane, nitrogen peroxide, nitric and nitrous oxides.

Capstick's rule, according to which the cathode potential fall of a compound gas is the sum of the separate values calculated for the component atoms, has not been verified. J. C. P.

Aluminium in the Potential Series. CHARLES M. VAN DEVENTER and H. VAN LUMMEL (*Chem. Weekblad*, 1907, **4**, 771—781. Compare Neumann, Abstr., 1894, ii, 373).—The chemical behaviour of amalgamated aluminium supports Neumann's view that this metal should be placed to the left of zinc in the potential series. The inactivity of ordinary aluminium in a zinc | acid | aluminium cell is caused by a coating of aluminium oxide, which with amalgamated aluminium is much less stable. The fact that this coating is a leaking insulator explains the abnormal electrical behaviour of ordinary aluminium, a view in accord with the experimental results obtained with such leaking insulators as ethyl and propyl alcohols containing water or acid. A. J. W.

A Gas Generated from Aluminium Electrodes. R. VON HIRSCH and FREDERICK SODDY (*Phil. Mag.*, 1907, [vi], **14**, 779—784). —It has been shown (Hirsch, *Physikal. Zeitsch.*, 1907, **8**, 461) that when cathode rays are generated by means of an influence machine in pure gases, the relation between the gas pressure, p, and the discharge potential, V, can be represented by the expression: $p^2V=$constant. This does not hold good for gaseous mixtures, as is now confirmed with mixtures of hydrogen with nitrogen and helium. During the passage of the discharge, a gas is evolved continuously from the electrodes if these are of aluminium. This is a pure gas, as the value 10,292 for p^2V remains satisfactorily constant. As hydrogen has $p^2V=38,120$, the molecular weight of the new gas must be 4 or some multiple. It is shown to be not identical with helium, water vapour, carbon dioxide, methane, acetylene, cyanogen, or hydrogen cyanide; with the exception of helium, these gases either decompose or polymerise under the influence of the discharge. The new gas is obtained from German-, but not from English-made bulbs, apparently because of the presence of sodium in the aluminium electrodes of the former. An English bulb, having the aluminium electrodes alloyed with sodium on the surface, evolved a gas similar to that obtained from the German bulbs, but containing small amounts of carbon dioxide. It is suggested that the unknown gas may be a modification of hydrogen, as ozone is of oxygen, capable of withstanding the discharge of an influence machine, but decomposed by that of a coil. G. Y.

Nickel Oxide Electrode in the Jungner-Edison Accumulator. JULIAN ZEDNER (*Zeitsch. Elektrochem.*, 1907, **13**, 752—755. Compare Abstr., 1906, ii, 65, 595).—Polemical. A criticism of a paper by Foerster (*Zeitsch. Elektrochem.*, 1907, **13**, 414). The author maintains that (1) the recently-charged nickel oxide electrode does not contain the oxide, NiO_2; (2) the oxide in the recently-charged electrode has the composition $Ni_2O_3,3H_2O$, and not $Ni_2O_3,1{\cdot}2H_2O$, whilst in the discharged electrode it has the composition $Ni(OH)_2,2H_2O$, and not $Ni(OH)_2$. W. H. G.

Signification of so-called Alternating Current Passivity. ALBERT LÖB (*Zeitsch. Elektrochem.*, 1907, **13**, 789—790. Compare Le Blanc and Schick, Abstr., 1904, ii, 229).—When an alternating current is passed through a solution of potassium cyanide between copper electrodes, the amount of copper which dissolves not only depends on the frequency of the current alternation, the concentration of the solution, and the current density, but also on the surface condition of the electrodes. The diminution in the amount of copper which passes into solution after suitable treatment of the electrodes has been ascribed to a passive condition of the metal, but, as the author shows, the observed facts can be readily explained on the assumption of super-tension phenomena. The ease with which hydrogen is liberated depends on the character of the electrode surface, and, as the super-tension increases, the amount of hydrogen liberated by the current will decrease, and, as a consequence, the amount of copper liberated will increase. Corresponding with the higher value of the super-tension of a zinc electrode, the phenomenon is more pronounced than in the case of copper, whilst with nickel it is less evident by reason of the smaller super-tension value.

The differences between the quantities of crystalline and polished metals which pass into solution are not constant, but decrease with decreasing frequency of alternation. As the time intervals between one current impulse and the subsequent opposing impulse increases, the metal ions are in increasing numbers converted into complex ions. As a consequence of this, super-tension has a gradually diminishing influence on the result of the electrolysis, and hydrogen will be liberated almost exclusively, in spite of the increased voltage necessitated by the existence of super-tension. H. M. D.

Dulong and Petit's Law. ALBERT WIGAND (*Ann. Physik*, 1907, [iv], **24**, 601—606. Compare Abstr., 1907, ii, 70).—A criticism of Laemmel's views (Abstr., 1905, ii, 300; 1907, ii, 530). J. C. P.

Critical Temperatures of Solutions. III. Solutions in Methyl Chloride, Ethyl Ether, and Methyl Alcohol. MIECZYSLAW CENTNERSZWER (*Zeitsch. physikal. Chem.*, 1907, **61**, 356—365. Compare Abstr., 1906, ii, 272).—The author has determined the critical temperature of variously concentrated solutions of (1) triphenylmethane, anthracene, phenanthrene, diphenylamine, resorcinol, and benzil in methyl chloride; (2) triphenylmethane, naphthalene, phenanthrene, diphenylamine, resorcinol, and benzil in ethyl ether; (3) potassium iodide in methyl alcohol. Whereas, according to van't Hoff, the "relative molecular elevation of the critical temperature" K/MT_1 (K = molecular elevation of the critical temperature, M = molecular weight of the solvent, T_1 = critical temperature of the solvent) should be a constant, the author's results show that this is only approximately the case. The value of K/MT_1 is to some extent dependent on the nature of the solvent and of the dissolved substance; it diminishes as the interval between the critical temperatures of the solvent and solute diminishes.

The more exact formula advanced by van Laar has also been considered, but the available data are hardly sufficient for a strict examination of its applicability. J. C. P.

Condition of Substances in Absolute Sulphuric Acid. ARTHUR HANTZSCH (*Zeitsch. physikal. Chem.*, 1907, 61, 257—312).—Sulphuric acid, which from analysis appears to be 100% strength, may not be cryoscopically pure; that is, its freezing point may be raised by the addition of water or sulphur trioxide. For the purposes of this research, the author has prepared absolute sulphuric acid by starting with an acid containing a little anhydride, and adding weighed quantities of water until the maximum freezing point, 10·46°, was reached. Acid which has this maximum freezing point has also a minimum conductivity $k=0·01$ at 25°.

The latent heat of fusion of sulphuric acid has been determined by Knietsch, at the author's request, and found to be 22·82 cal. per gram. The mean molecular depression of the freezing point, deduced from the behaviour of trinitrobenzene, trinitrotoluene, dinitromesitylene, trinitrophenol, trichloroacetic acid, phthalic anhydride, anhydrous oxalic acid, methyl sulphate, and tellurium as solutes, is 70°. When this figure is put in van't Hoff's formula, the latent heat of fusion is calculated to be 22·94 cal., in good agreement with the direct experimental figure just recorded. This agreement shows that the foregoing solutes dissolve in sulphuric acid without decomposition or dissociation; this result is confirmed by the fact that these substances, unlike many others, do not increase the conductivity of the absolute sulphuric acid.

The majority of inorganic and organic substances which dissolve in absolute sulphuric acid without decomposition depress the freezing point to an abnormally great extent, and appear therefore either to be ionised themselves or to unite with the sulphuric acid to form dissociable compounds. Among the substances which exhibit this behaviour are water, sodium, potassium, ammonium, and diazonium acid sulphates, dimethylpyrone, methyl alcohol, ethyl ether, anthraquinone, ethyl acetate, acetic, monochloroacetic, benzoic, malonic, and fumaric acids.

It is noteworthy that in all these cases the molecular weight calculated from the freezing-point depression is about two-thirds of the theoretical value. With the sulphates of bivalent metals, carbamide, succinic, maleic, and phthalic acids, the molecular weight calculated from the freezing-point depression is about half the theoretical value. In other cases, still more abnormal values are observed; the molecular weights calculated for triphenylcarbinol and *p*-tri-iodotriphenylcarbinol are about one-third of the normal values; paraldehyde and metaldehyde are first depolymerised, and then give a value of the molecular weight from one-half to two-thirds of the normal value for acetaldehyde. Nitric acid (not quite absolute) gives a depression which is rather more than double the theoretical depression. In all the cases referred to, the calculated molecular weight, even where it is abnormally small, is independent of the concentration.

The substances for which abnormally small molecular weights are found by the cryoscopic method have the power of increasing the conductivity of absolute sulphuric acid, and it is found that the specific conductivity of these solutes increases proportionally to the concentration, so that over the range of concentration studied by the author the molecular conductivity is constant.

In explaining the difference from water, in that many electrolytes dissolved in absolute sulphuric acid have constant molecular weight, and constant molecular conductivity, it must be borne in mind that sulphuric acid must itself contain considerable quantities of the ions $H^\cdot$ and HSO_4', and that the concentrations of these ions will be markedly affected by the addition of an acid sulphate. The author considers it probable, especially in view of the very high dielectric constant of sulphuric acid, that the acid sulphates are completely dissociated.

The uniform results recorded above for solutions of water, methyl alcohol, &c., lead the author to conclude that all these varied compounds, when dissolved in absolute sulphuric acid, unite with the solvent, forming acid oxonium salts, which are dissociated in the same manner as alkali or ammonium sulphates. Just as a molecule of ammonia may attach itself to a hydrogen ion, forming the ammonium ion $NH_4^\cdot$, so it is supposed that a molecule of water may similarly attach itself, forming the "hydronium" ion $H_3O^\cdot$, so that a solution of a little water in sulphuric acid is a dissociated solution of hydronium sulphate. A similar explanation is applied in the other cases, so that solutions of methyl alcohol and ethyl ether in absolute sulphuric acid are to be regarded as containing dissociated methylhydronium sulphate and diethylhydronium sulphate. From this point of view, the pyrone derivatives fall into line with the other oxygen compounds. In the case of acetic and other weak organic acids, which in sulphuric acid solution behave themselves cryoscopically and electrically like water or ammonia, it must be supposed that they are forced by the very strong sulphuric acid to assume basic functions. Solutions of acetic and benzoic acids in sulphuric acid are therefore to be regarded as containing dissociated acetyl- and benzoyl-hydronium sulphates. The exceptional behaviour of the triphenylcarbinols, in giving abnormally great depression of the freezing point and abnormally great increase of conductivity, is probably due to their forming sulphates with elimination of water, this water being at once converted into dissociated hydronium sulphate.

When organic acids of greater strength than acetic or benzoic acid are considered, the readiness to form salts with sulphuric acid diminishes, until in the case of trichloroacetic, oxalic, and picric acids, the affinity constants of which cannot be determined directly, the salt-forming power has disappeared; these acids, when dissolved in sulphuric acid, are cryoscopically normal and electrically indifferent. A further class of substances comprises the strongest inorganic acids (such as nitric acid) and the sulphonic acids, which when dissolved in absolute sulphuric acid appear to be dissociated, not as oxonium salts, but as acids, their dissociating tendency, $XOH \longrightarrow XO' + H^{\cdot}$, being so great that even in sulphuric acid they are ionised in the usual way.

The molecular conductivities of the various solutes in absolute sulphuric acid differ much less than they do in water, probably because the variation in the mobilities of the cations is eclipsed by the very great mobility of the ion HSO_4', which is not only common to the solutes, but is produced also by the dissociation of the solvent (see Hantzsch and Caldwell, Abstr., 1907, ii, 328). J. C. P.

Analysis of the Lowering of the Freezing Point in Physiological Fluids. Ernst Tezner (*Zeitsch. physiol. Chem.*, 1907, **54**, 95—109).—The depression of the freezing point of an aqueous solution containing both electrolyte and non-electrolyte is (very slightly) less than the sum of the depressions caused by the components when by themselves. This difference is attributed to reduction of the dissociation of the electrolyte by the non-electrolyte. G. B.

Transition Temperature of Manganous Chloride. Theodore W. Richards and Franz Wrede (*Zeitsch. physikal. Chem.*, 1907, **61**, 313—320. Compare Richards and Churchill, Abstr., 1898, ii, 555; 1899, ii, 354; Richards and Wells, Abstr., 1903, ii, 411; 1906, ii, 727).—Especially pure manganous chloride has been prepared in two ways: (1) by repeated crystallisation of the commercially pure chloride; (2) by repeated crystallisation of the nitrate, precipitation of the nitrate solution by pure ammonium carbonate, and preparation of the chloride from the precipitated carbonate. Both specimens gave the same value, $58{\cdot}089° \pm 0{\cdot}005°$ (on the international hydrogen scale), for the transition temperature, $MnCl_2,4H_2O \rightleftharpoons MnCl_2,2H_2O + 2H_2O$. As manganous chloride is very readily prepared in a pure condition, its transition temperature is very well suited for use as a fixed point in thermometric work.

The authors describe a thermostat which enables them to keep the exposed part of the stem at nearly the same temperature as the thermometer bulb. J. C. P.

Outline of a New System of Thermodynamics. Gilbert Newton Lewis (*Zeitsch. physikal. Chem.*, 1907, **61**, 129—165. Compare Abstr., 1901, ii, 639).—It is pointed out that in the development of physical chemistry thermodynamics has been applied along two main lines. Some investigators, for example, Gibbs, Duhem, and Planck, have started from the fundamental equations involving the entropy and the thermodynamic potential. Others, such as van't Hoff, Ostwald, Nernst, and Arrhenius, have adopted the method of applying the cycle process to special problems. The latter unsystematic method of procedure has led to a large number of independent formulæ, largely of an approximate character, and it is the author's aim to develop by ordinary operations a systematic series of thermodynamical equations, which are similar to those at present in use among physical chemists, but are at the same time strictly exact.

The author works with a magnitude which he terms "activity," to be regarded as the ideal measure of the tendency of a given kind of molecule to depart from the conditions in which it finds itself at any given moment. The "activity" ξ is further related to the "fugacity" ψ (see *loc. cit.*) by the equation $\xi = \psi/RT$. With the help of the foregoing conception, the author reaches a number of exact general equations from which, by approximation, the common formulæ for the change of equilibrium with temperature, for the *E.M.F.* of a reversible cell, for the depression of the freezing point, &c., can be readily deduced. J. C. P.

New Apparatus. Appliance for Maintaining Constant Temperatures in Drying-Ovens. A Fractionating Column. Receiver for Mitscherlich's Apparatus (Phosphorus Distillation). JOSEF HABERMANN (*Zeitsch. anal. Chem.*, 1907, **46**, 574—581).—The apparatus for maintaining a constant or predetermined temperature in a drying-oven is similar in shape to an ordinary Soxhlet extractor; there is no siphon tube, however, and a two-way tap is placed on the lower stem, so that the latter may be placed in connexion with the wide upper tube, or the two tubes may be cut off from each other and the upper one connected with an exterior vessel. The lower stem of the apparatus is fixed in an opening at the top of the oven. A mixture of amyl alcohol and ethyl alcohol is placed in the outer jacket of the drying-oven and heated to boiling. The vapour passes up through the side tube of the apparatus into a condenser at the top, and the condensed liquid is collected in the wide upper tube. If the boiling point of the alcoholic mixture be too low to give the required temperature, the collected liquid is run off into the outside vessel until the correct temperature is attained. The tap is then turned, so that the liquid condensed subsequently returns to the oven.

The fractionating column described is also of similar shape. A condenser is provided inside the top of the wide part of the apparatus, and the distilled liquid is collected at the lower part, being returned to the distillation flask or run off as desired through a two-way tap. A thermometer is placed in the side tube of the apparatus so that the temperature of the vapour can be ascertained.

The receiver consists of a flask fitted with a double-bored cork. The end of the condenser passes through one hole in the cork, whilst a delivery tube is fitted in the other. In distilling substances which yield distillates having a disagreeable odour, for instance, in testing for phosphorus poisoning, the distillate is collected in the flask while the gases pass through the flask and out of the delivery tube into a kind of filter-pump. The latter receives the waste water from the condenser, and the gases are thus carried away. W. P. S.

The Method of Limiting Densities, and its Application to the Atomic Weight of Nitrogen. PHILIPPE A. GUYE (*Compt. rend.*, 1907, **145**, 1164—1166. Compare Abstr., 1907, ii, 437, 605).—A reply to D. Berthelot (compare Abstr., 1907, ii, 154, 155, 668, 680, 740). The author maintains that the mean value 14·005 for the atomic weight of nitrogen deduced by Berthelot from the limiting densities of nitrogen, nitrous and nitric oxides is untrustworthy, since the values for the atomic weight of the element diminish as the critical temperatures of the gases from which they are calculated increase, as is shown in the following table :

Gas.	N_2.	NO.	N_2O.	NH_3.
Atomic weight of N...........	14·008	14·006	13·999	13·992
Absolute critical temperature	128°	179°	309—312°	425°

The value N = 14·010, obtained as the mean of six independent determinations by chemical analysis of nitrous and nitric oxides (limits 14·007 and 14·015), is more exact (compare Abstr., 1906, ii, 349). M. A. W.

Adsorption and Occlusion. Nature of the so-called Solid Phase. MORRIS W. TRAVERS (*Zeitsch. physikal. Chem.*, 1907, **61**, 241—248. Compare Abstr., 1906, ii, 730).—A criticism of some points raised in Freundlich's papers (Abstr., 1907, ii, 155, 534).

The author is strongly of opinion that the term "solid solution" should be confined to isomorphous mixtures, that is, homogeneous mixtures which are themselves crystalline, and the components of which have similar, if not the same, crystalline form. Adsorption and occlusion, apart from the formation of isomorphous mixtures and from the mechanical enclosure of the substance which appears to be dissolved, are interpreted as the formation of a solution in an amorphous substance. Such substances are practically liquid, and appear to be solid only because they have a certain mechanical rigidity. J. C. P.

Adsorption and Occlusion. HERBERT FREUNDLICH (*Zeitsch. physikal. Chem.*, 1907, **61**, 249—254).—A reply to Travers (preceding abstract). Whilst the latter considers that adsorption consists in a process of solution modified by surface phenomena, the author holds the view that surface condensation is the main element in adsorption, and that the formation of solid solutions is a secondary effect.

It is pointed out that the variation in the adsorption of carbon dioxide by charcoal with temperature (studied by Travers) is very similar to the corresponding variation in the adsorption of acetic acid by charcoal in aqueous solution (studied by the author). J. C. P.

Dissociation by Adsorbing Substances of the Compounds formed by Basic and Acidic Dyes. LOUIS PELET-JOLIVET (*Compt. rend.*, 1907, **145**, 1182—1183).—Crystal ponceau and methylene-blue form a compound containing 1 mol. of the former to 2 mols. of the latter (compare Abstr., 1904, ii, 794), and similar compounds have been prepared containing crystal ponceau, 1 mol., and magenta or safranine, 2 mols., or naphthol yellow S, 1 mol., and of methylene-blue, magenta, or safranine, 2 mols. (compare Seyewetz, Abstr., 1900, i, 356). These compounds are much less soluble in water than either of the constituents, the solubility of the compound of ponceau and methylene-blue is 0·201 gram per litre at 100°, or 0·045 gram per litre at 15°, and the solubilities at 15° of the compound of methylene-blue with eosin and naphthol yellow S are 0·158 and 0·042 gram per litre respectively. Certain adsorbent substances, such as wool, animal charcoal, or precipitated and calcined silica, cause dissociation of aqueous solutions of these compounds, and absorb the basic constituent if the original solution is neutral or alkaline and the acidic constituent if the original solution is acid. This phenomenon is readily explained by the colloidal theory of dyeing, according to which the adsorbent substances are in the colloidal state, and are negatively charged and absorb the positive or basic constituent in neutral or alkaline solution, and positively charged and absorb the negative or acid constituent in acid solution. The behaviour of the compound of eosin and methylene-blue as a stain for certain bacilli can be explained similarly (compare Marino, Abstr., 1906, ii, 189); the nucleus of the cell in the colloidal state is positively charged and absorbs the eosin, and the remainder of the protoplasm, also in the colloidal state, is negatively charged and absorbs the methylene-blue. M. A. W.

Dissociation as Measured by Lowering of Freezing Point and by Electrical Conductivity. Bearing on the Hydrate Theory. The Approximate Composition of the Hydrates formed by a Number of Electrolytes. XIX. HARRY C. JONES and J. N. PEARCE (*Amer. Chem. J.*, 1907, **38**, 683—743).—A summary of the evidence so far obtained for the existence of hydrates in aqueous solutions is first given, most of which is recorded in Abstr., 1905, ii, 8, 73, 445, 509, 687, 794; 1906, ii, 66, 327, 737, 827; 1907, ii, 147, 211, 212, 438, so far as the contributions of Jones and his co-workers are concerned.

In the present investigations, attention was directed to determining (*a*) the relation between the degree of dissociation as measured by (1) freezing-point methods and (2) conductivity methods; (*b*) the extent to which conductivity of a solution, and the relative velocities of different ions, are influenced by hydration of ions, and (*c*) the trustworthiness of conductivity methods for measurement of the degree of dissociation. For this purpose, solutions of fifteen salts and three acids have been systematically studied for concentrations ranging from 0·01 to 2·0 normal. Details of the methods of investigation and the modes of expressing the results are given in the original, together with full tabular statements of the experimental data obtained. Only the general conclusions arrived at can be given.

The molecular lowerings of freezing point in all cases pass through a well-marked minimum. The molecular lowerings, calculated from conductivity measurements of dissociation, decrease regularly with increase of concentration. The value of the molecular lowering varies directly with the number of mols. of water with which the salt under investigation crystallises from water.

The total amount of combined water decreases with increase in concentration to a minimum, and then increases regularly with the concentration. The amount of water in combination with 1 mol. of a salt is large in dilute solutions, where ions predominate, and decreases as dissociation is lowered, becoming nearly constant at greater concentration.

The hydrating of a salt is essentially a function of the cation, and is an inverse function of the atomic volume of the latter. Those cations which possess the greatest migration velocities have the least hydrating powers, and the converse of this is also true.

The effect of the hydration of those ions with small atomic volumes on their migration velocity is greater than that of the small hydration of those possessing large atomic volumes on their migration velocity.

In all the cases examined, it was found that the dissociation in dilute solution, as measured by the conductivity method, is less than that calculated from the lowering of freezing point, and this difference is the greater the more dilute the solutions examined are, so that it is probably connected with the increase in friction between the solvent and ion due to the greater surface presented by the latter as it becomes more hydrated at greater dilution. Comparable results can only be expected by the two methods in the cases of salts which crystallise from solution in the anhydrous condition, but in cases of this type comparable values were only obtained at concentrations near to that at which molecular lowering is at a minimum. T. A. H.

Semi-Electrolytes. Maurice Prud'homme (*J. Chim. Phys.*, 1907, 5, 497—510).—By the combination of two equations shown in a previous paper (Abstr., 1907, ii, 527) to hold for certain weak electrolytes, the equation (1) $\gamma = A\log(1-\gamma)^{-1}$, where γ is the coefficient of ionisation, is shown to hold within wide limits of dilution for acetic acid and ammonia, and A has the same numerical value for the two electrolytes in corresponding dilution, and is constant up to fairly high dilutions. Consequently, for acetic acid and ammonia, the equation (2) $\gamma/\gamma' = \log(1-\gamma)^{-1}/(1-\gamma')^{-1}$ (where γ and γ' are the respective coefficients of ionisation in corresponding dilution) ought to hold, and this is shown to be the case. Putting $\gamma = \lambda/\lambda_\infty$, where λ and λ_∞ represent the molecular conductivities at a particular dilution and at infinite dilution respectively, equation (1) may be written in the form $\lambda = A\ \lambda_\infty \log[\lambda_\infty/(\lambda_\infty - \lambda)]$, and by means of this equation λ_∞ can be calculated for semi-electrolytes from the observed values of λ and the values of A obtained for acetic acid and ammonia. λ_∞ has been calculated in this way for a number of weak acids and bases, and the values obtained are in satisfactory agreement with those given by the usual methods. G. S.

Diffusion of Electrolytes in Aqueous Solutions and in Gelatin. B. Lino Vanzetti (*Atti R. Accad. Lincei*, 1907, [v], 16, ii, 655—657).—The formation of two separate zones of precipitate when, for example, barium chloride and silver sulphate solutions are allowed to diffuse into the opposite ends of a column of gelatin is explained by Buscaglioni and Purgotti (*Atti R. Ist. Bot. Pavia*, 1905, N.S., 11) as being due to the fact that the ions in solution obey Bunsen's law for the diffusion of gases. Bruni and Vanzetti (Abstr., 1907, ii, 74), on the other hand, regard the phenomenon as one of supersaturation.

The author has made similar experiments, using, as the diffusing salts, ammonium, potassium, rubidium, or cæsium chloride in 4*N*-solution, on the one side, and semi-normal sodium platinichloride on the other. With ammonium and potassium chlorides, the precipitated platinichloride is deposited at the same position in the gelatin column, and the same is the case with rubidium and cæsium chlorides, in spite of the varying ionic velocities of the different metals. Buscaglioni and Purgotti's hypothesis is hence untenable. T. H. P.

Comparison of Acids and Pseudo-Acids in Pyridine Solution.

ARTHUR HANTZSCH and KENNETH S. CALDWELL (*Zeitsch. physikal. Chem.*, 1907, **61**, 227—240).—The authors have studied the conductivity of a number of true acids, strong and weak, and of a number of pseudo-acids in pyridine solution. The order of the true acids, arranged according to the conductivity of their pyridine solutions, is roughly the same as when they are arranged according to the magnitude of their affinity constants in aqueous solution. Pseudo-acids, compared among themselves, exhibit an exactly analogous behaviour. When, however, the conductivity of a true acid in pyridine is compared with that of a pseudo-acid which is of approximately the same strength in aqueous solution, it is found that the conductivity of the pseudo-acid is very much greater. This result has been verified in the case of nitroform and trinitrophenol in comparison with oxalic acid, also in the case of pseudo-acids which are of medium strength in aqueous solution (such as nitrourethane, dinitrophenol, benzoylcyanamide, "saccharin") and in the case of weak or very weak pseudo-acids (such as mononitrophenol, *p*-benzoquinoneoxime, cyanuric acid, methylnitroamine) in comparison with mediumly strong to weak monocarboxylic acids. Only in the case of the pseudo-acid, nitromethane, has no such behaviour been observed.

The conclusion may be drawn that when a hydrogen compound dissolved in pyridine conducts much better than a true acid, which in water is of about the same strength, then the former must be a pseudo-acid. Thus it is certain that hexanitrodiphenylamine undergoes isomeric change as a pseudo-acid. J. C. P.

Conductivity of the Sodium Salts of the Isomeric Hydroxybenzoic Acids. The Question of the Mobilities of Isomeric Anions.

HEINRICH LEY and O. ERLER (*Zeitsch. Elektrochem.*, 1907, **13**, 797—799).—The conductivity of sodium salicylate is at any given dilution greater than that of sodium *m*-hydroxybenzoate or sodium *p*-hydroxybenzoate. This cannot be due to extra dissociation of the phenolic hydrogen atom in salicylic acid, for experiments have shown that of the three disodium salts that of the ortho-acid is hydrolysed to the greatest extent, so that the second hydrogen atom of this acid is only very slightly acidic in character.

The superior conductivity of sodium salicylate is probably due to the greater mobility of the ortho-anion, this again being probably due to the greater degree of hydration of the two isomeric anions. In this connexion, it is noteworthy that the sodium salts of *o*- and *p*-methoxybenzoic acids have practically equal conductivities. J. C. P.

Polymorphism of Liquids. Daniel Vorländer (*Ber.*, 1907, **40**, 4527—4537. Compare Abstr., 1907, ii, 441, 442).—The crystalline liquids obtained when various unsaturated compounds are fused cannot be chemically isomeric with the crystalline solid or amorphous liquid phases, since acetylene derivatives, such as the acetyl and benzoyl derivatives of dihydroxytolane, yield crystalline liquids like the corresponding stilbene compounds, and the possibility of isomerism, even of stereoisomerism, is excluded in these compounds.

The *dibenzoyl* derivative crystallises from a mixture of benzene and alcohol in colourless prisms, m. p. 214° and 254°. Measurements of dielectric constants show that the values are practically the same for the two liquid phases of ethyl anisylideneaminocinnamate, although discontinuities at the two transition points are observed (compare Abegg and Seitz, Abstr., 1899, ii, 623).

Various crystallographic properties of crystalline liquids can be ascertained and made use of in determining the crystalline system to which the liquid belongs. The behaviour of the liquids in converging polarised light points to their being uniaxial, a view which is supported in different ways. The liquid crystals have thus a higher degree of symmetry than the solid, crystalline phases of the same substances, which are mainly monoclinic or rhombic. The following esters: ethyl azoxybenzoate, methyl, ethyl and propyl azoxycinnamates, ethyl bromoazoxycinnamate, ethyl azocinnamate, ethyl anisylideneaminocinnamate, ethyl piperonylideneaminocinnamate, ethyl phenylbenzylaminocinnamate, ethyl anisoleazocinnamate, ethyl acetoxybenzeneazocinnamate form liquid plates and rods, and in a narrow sense of the word are thus isomorphous. The cinnamates are characterised by the readiness with which they crystallise. The five last-named substances are isodimorphous, yielding two enantiotropic, crystalline liquid modifications. The benzoate of the ester of hydroxybenzylideneaminocinnamate forms three crystalline, liquid phases. Methoxy- and phenyl derivatives of aromatic substances closely resemble one another in the crystalline, liquid state, although there are a few exceptions.

The formation of liquid crystals appears to be characteristic of para-substituted derivatives, and several examples are cited which show that the property may be made use of for determining the constitution of certain benzene derivatives. J. J. S.

Reciprocal Solubility of Oil of Turpentine and Methyl Sulphate. M. Dubroca (*J. Chim. phys.*, 1907, **5**, 463—487).—The determinations were made by Alexéeff's method at approximately atmospheric pressure, the temperatures at which the milkiness (due to partial separation of the components) just appeared on cooling slowly being observed. The methyl sulphate was purified by repeated distillation, and, although slightly acid, gave very little colour, and only a slight elevation of temperature on mixing with oil of turpentine; its density and refractive index at 15° and 25° are given.

The curve representing the results, obtained by plotting the composition of the mixture against the temperatures at which separation into two phases commences, is of the parabolic form usual for partially miscible, binary liquids. The components are completely miscible in all proportions above 108·2°.

The effect on the miscibility of the components of the presence of sulphuric acid in the methyl sulphate, of the period during which the mixture has been kept in sealed tubes before the observations, and of the age of the turpentine has been investigated; the addition of a little petroleum to the binary mixture has the same effect as the employment of a specimen of oil of turpentine fresher than that to which the petroleum was added. G. S.

Colloidal Solutions. THE SVEDBERG (*Nova Acta Soc. Sci. Upsala*, 1907, [iv], 2, No. 1, 1—160. Compare Abstr., 1906, ii, 330; 1907, ii, 17, 160, 529, 535, 536).—The paper contains a complete account of the author's work, much of which has been already published.

New experiments on the effect of the oscillatory discharge with large capacities show that the yield of colloid increases with the capacity when the current strength is constant.

The proportion of carbon in the colloidal solutions of various metals, prepared by pulverisation in ethyl ether under constant electrical conditions, has been examined. For the same metal, the carbon content of the colloid is proportional to the specific decomposition of the medium. For different metals, the proportion of carbon increases with the decomposition of the medium, but the increase is much slower in the former case. With an oscillatory discharge, the proportion of carbon is very much smaller than with a direct current discharge. Using the oscillatory discharge and a capacity of about 0·1 micro-farad, the percentage of carbon in the separated metal is about 0·2 in the case of a metal which is readily pulverised, and about 2·0 in the case of a metal pulverised with difficulty. With larger capacities, colloidal metals, which are practically free from carbon, may be expected to be obtained.

Experiments on colloid formation in liquid methane cooled by liquid air show that the phenomenon of cathodic pulverisation is the same at this low temperature as it is at the ordinary temperature. The colloidal solution of sodium has a red colour; that of potassium is bluish.

After a critical examination of the many theories which have been put forward in regard to the nature of colloidal solutions, the author arrives at the conclusion that factors other than electrical charges and capillary forces play an important part in such systems. From a study of the behaviour of an inactive colloidal substance of small solution pressure (platinum) in a medium of small ionising power (ethyl ether), it is found that such solutions have a definite critical temperature (coagulation temperature), and that addition of a small quantity of a foreign substance raises the critical temperature. The curves which express the dependence of the critical temperature on the concentration of the added substance are asymptotic to the negative temperature axis.

Some observations relating to the Brownian movement of the colloidal particles indicate that the cessation of this movement on the addition of electrolytes is not due to any specific action of the ions, but to the increasing size of the particles. By gradual addition of aluminium sulphate to an aqueous solution of colloidal silver, the direction of motion of the particles in an electric field can be reversed. Corresponding with this change, the velocity of the particles diminishes as the isoelectric point is approached, but the amplitude of the Brownian movement remains unchanged, and the author concludes that this movement cannot be due to electrical forces.

H. M. D.

Influence of the Reaction of the Medium on the Size of Colloidal Granules. ANDRÉ MAYER, GUILLAUME SCHÆFFER, and E. TERROINE (*Compt. rend.*, 1907, **145**, 918—920).—The authors have examined a large number of colloidal solutions, including colloidal metals (gold, silver, platinum), inorganic colloids (arsenic trisulphide, mercuric sulphide), and organic colloids (soaps, dyes and indicators, alkaloids, starch, albumin). They find that the size of the colloidal granules is increased by the addition of a trace of acid to negative colloidal solutions, or of a trace of alkali to positive colloidal solutions, whilst the addition of acid to the positive, or alkali to the negative, colloidal solutions causes a diminution in the size of the granules. Further, precipitation of a colloidal solution is induced by dialysing a negative solution containing an excess of alkali, or a positive solution containing an excess of acid. M. A. W.

Investigation of Colloids by the Filtration Method. HEINRICH BECHHOLD (*Zeitsch. physikal. Chem.*, 1907, **60**, 257—318; *Biochem. Zeitsch.*, 1907, **6**, 379—408).—The author describes in detail a method which has been worked at by him which permits of the separation of colloids in solution from the solvent, as well as the separation of mixtures of colloids of different-sized particles from one another by fractional filtration.

The filter material is made to impregnate filter paper in a special apparatus, and when in use the impregnated paper is supported by fine nickel gauze. The pressures used are from two to five atmospheres, and in one form of the machine a stirrer is used, by means of which the material to be filtered is kept violently agitated. The filter materials employed were gelatin of various concentrations, formalised gelatin, and acetic collodion solidified by washing in water.

The "fineness" of the filter is dependent upon the concentration of the gelatin. It was established that gelatin-filters have pores of unequal size, and that the particles in a colloidal solution are mostly of unequal size. Data are given with regard to a number of colloids, both organic and inorganic, in their relationship to gelatin-filters (Prussian blue, platinum, arsenious sulphide, gold, ferric hydroxide, silicic acid, collargol, lysargin, bismon, hæmoglobin, serum-albumin, globulin, gelatin, hæmatin, sodium lysalbinate, dextrin, litmus, chlorophyll).

A mixture of albumoses was separated into its constituents by fractional filtration. Many substances, especially those physiologically active, such as rennin, arachnolysin, staphylolysin, are strongly adsorbed by the material of the filter, others slightly so, for instance, albumins, albumoses, hæmoglobin, anti-rennin, and diphtheria-toxin. Dissolved colloids can absorb other dissolved colloids. "Protective" colloids have a favourable influence on the filtration of inorganic colloids by diminishing friction. It is shown that the possibility of filtering certain mixtures is dependent on the sequence in which the constituents are brought together. The author calls this the "sequence phenomenon." A mixture of Prussian-blue, serum-albumin, and oxalic acid, in the order given, passes partially through a gelatin-filter, whilst a mixture in sequence, Prussian-blue, oxalic acid, and serum-albumin, does not. In many cases, dialysis may be replaced by gelatin filtration, but not universally so. The great advantage of a filtration method over dialysis consists in that the solutions do not become dilute, and that the apparatus may readily be sterilised and kept sterile. The sequence of the examined colloids as regards the size of the particles, when grouped according to the filtration method, agrees with what has been deduced from theoretical considerations and the use of the ultra-microscope.

Gelatin-filters can be used for obtaining sterile filtrates. The author shows by the filtration method that in the case of a non-poisonous disinfectant (tetrachlorodiphenol), although powerfully active against broth cultures, its activity in internal antisepsis is dependent on the fact that the blood-serum combines with the disinfectant, the bacterial growths being not shown any preference in the matter. G. S. W.

Diastatic Function of Colloids. JACQUES DUCLAUX (*Compt. rend.*, 1907, **145**, 802—804).—From the fact that the diastatic action (oxidation of quinol, decomposition of hydrogen peroxide) of certain salts in aqueous solution is the more energetic the weaker the acid forming the salt, that is, the more the latter is hydrolysed, it has been deduced that the active part of the dissolved salt is that which is hydrolysed. The author has studied the decomposition of hydrogen peroxide by Graham's colloidal solution of ferric hydroxide, (Fe_2Cl_6,nFe_2O_3), which is completely hydrolysed when n exceeds 40, and then consists of micro-cells of Fe_2Cl_6,nFe_2O_3 in equilibrium with an intercellular, very dilute solution of hydrogen chloride containing no appreciable quantity of iron. The properties of the solution vary with the value of n, but its catalytic activity bears no fixed relation to the total quantity of iron present, even when completely hydrolysed. As n increases, the reaction-constant k increases in almost the same proportion, and is not rendered constant by multiplying by numbers expressing the acidity of the solution. But when the values of k are calculated, not from the total quantity of iron, but from that present as chloride, that is, the part which is physically and chemically "active," and corrected for the greater or lesser acidity of the liquid, concordant results are obtained for a large number of different colloidal ferric solutions. Thus it is the "active" part of the colloid which determines its catalytic power. The completely hydrolysed solution contains no iron in the intercellular liquid, but the cells contain non-hydrolysed ferric chloride, which constitutes the "active" part, thus *the hydrolysed part of the ferric salt does not take part in the catalysis.* The latter deduction is confirmed by the fact that the catalytic activity of iron in freshly-prepared acid solutions (that is, non-hydrolysed) of ferric chloride is approximately the same as that in the colloidal solutions. The author concludes that the catalytic power is a property of the ion. The "active" part of these colloidal solutions is very sensitive to impurities, and their catalytic power is greatly weakened by addition of small quantities of such salts as potassium sulphate or ferrocyanide. E. H.

Calculation of Hydrocarbon Equilibria. H. VON WARTENBERG (*Zeitsch. physikal. Chem.*, 1907, 61, 366—372).—In reference to a recent paper by Sand (Abstr., 1907, ii, 814), it is pointed out that on the basis of Nernst's theory (Abstr., 1906, ii, 727) it is possible to predict the general course of organic reactions and the order of magnitude of the equilibrium constants. The paper contains a number of examples of the application of the said theory.

J. C. P.

Kinetics and Catalysis of the Hydrogen Peroxide–Thiosulphate Reaction. EMIL ABEL (*Monatsh.*, 1907, 28, 1239—1312).—The velocity constant of the reaction between hydrogen peroxide and a thiosulphate in acid solution, which is represented by the equation: $H_2O_2 + 2S_2O_3'' + 2H^{\cdot} = S_4O_6'' + 2H_2O$, when calculated according to the velocity equation for bimolecular reactions:

$$dx/dt = k[(H_2O_2) - x]\ [(Na_2S_2O_3) - x],$$

is found to be, as the average of a large number of determinations, $k = 1{\cdot}53$. The reaction is accelerated by hydrogen ions. From these kinetic results, the conclusion is drawn that during the reaction there is an intermediate separation of electrically neutral S_2O_3, which determines the velocity of the reaction. Iodine ions act catalytically on this intermediate stage of the reaction. The resulting acceleration, calculated according to the principle of co-existence from the separate, measurable parts of the reaction, is in good agreement with the experimental results. This constitutes the first case of the calculation of the catalytic acceleration of a reaction, which takes place even in the absence of a catalyst with measurable velocity.

The catalytic acceleration of the decomposition of hydrogen peroxide by iodine ions takes place, as was to be expected from theoretical considerations, in acetic acid solution, provided this contains sufficient acetate, in consequence of the diminished concentration of the hydrogen ions, and is in complete agreement with the results obtained by Bredig and Walton with neutral solutions.

The catalysis of the hydrogen peroxide-thiosulphate reaction also takes place equally well in acetic acid solution in presence of acetates. It follows (*a*) that the thiosulphate is oxidised with great velocity by hypoiodite directly to tetrathionate according to the equation: $IO' + 2S_2O_3'' + 2H^{\cdot} = S_4O_6'' + I' + H_2O$; (*b*) that the catalysis of the hydrogen peroxide-thiosulphate reaction by iodine ions does not necessarily require the intermediate separation of iodine, cases possibly occurring in which the reaction leads directly to the formation of the tetrathionate, that of the intermediate product, iodine, being completely suppressed, and (*c*) that the decomposition of hydrogen peroxide by the catalytic action of iodine ions is a catalysis of an intermediate reaction, the first stage being directly detected by the reaction with thiosulphate.

The addition of molybdic acid, even in the smallest concentrations, produces a far-reaching change in the nature of the reaction between hydrogen peroxide and thiosulphates. G. Y.

Esterification of Cinnamic and Hydrocinnamic Acids by Means of Alcoholic Hydrogen Chloride. ANTON KAILAN (*Monatsh.*, 1907, **28**, 1137—1161. Compare Abstr., 1906, ii, 659; 1907, i, 849; ii, 158, 242, 243, 674, 675, 676, 853).—The velocity of esterification of cinnamic and hydrocinnamic acids by means of hydrogen chloride and alcohol, containing only small amounts of water, is proportional to the concentration of the hydrogen chloride. The relation of the velocity constants to the concentrations of the water and hydrogen chloride are expressed by the equations: for cinnamic acid, $1/k = 0{\cdot}665 + 4{\cdot}876/c - 1{\cdot}678/c^2 + (2{\cdot}911 - 3{\cdot}212/c + 4{\cdot}358/c^2)w + (-27{\cdot}54 + 31{\cdot}78/c - 2{\cdot}284/c^2)w^2$, and for hydrocinnamic acid, $1/k = 0{\cdot}0601 + 0{\cdot}08337/c + 0{\cdot}005244/c^2 + (-0{\cdot}2169 + 0{\cdot}2494/c + 0{\cdot}03065/c^2)w + (-0{\cdot}4866 + 0{\cdot}4962/c)w^2$, which apply to solutions having the concentration of the water, $w = 0{\cdot}3 - 1{\cdot}3$, and of hydrogen chloride, $c = 0{\cdot}15 - 0{\cdot}66$. The esterification of cinnamic acid is greatly retarded by the α-ethylene linking, as is shown by the following values obtained for k. Cinnamic acid: $c = 0{\cdot}1667$, $w = 0{\cdot}052$, $k = 3{\cdot}61$; $c = 0{\cdot}333$, $w = 0{\cdot}052$, $k = 3{\cdot}41$; $c = 0{\cdot}6667$, $w = 0{\cdot}052$, $k = 3{\cdot}52$. Hydrocinnamic acid, with the same values for c and w, has $k = 128{\cdot}8$, $132{\cdot}2$, and $135{\cdot}2$ respectively.

In spite of the differences in velocity of esterification, the behaviour of cinnamic and hydrocinnamic acids is analogous to that of the acids previously studied. G. Y.

Esterification of Nitrocinnamic Acids by Means of Alcoholic Hydrogen Chloride. ANTON KAILAN (*Monatsh.*, 1907, **28**, 1163—1186. Compare preceding abstract).—The velocity of esterification of *o*- and *m*-nitrocinnamic acids by means of hydrogen chloride in alcoholic solution, containing at most only small amounts of water, is found to be proportional to the concentration of the hydrogen chloride, but that of *p*-nitrocinnamic acid appears to increase more rapidly than the hydrogen chloride concentration. The last point, however, is doubtful, as the accuracy of the determination of the velocity of esterification cannot be altogether depended on in consequence of the sparing solubility of the *p*-nitro-acid. The esterification of the *m*-nitro-acid in presence of much water has also been studied, and the constant expressed as a function of the concentrations of the water and hydrogen chloride by the equation $1/k = 1{\cdot}398 + 2{\cdot}768/c + 1{\cdot}04078/c^2 + (13{\cdot}62 - 16{\cdot}81/c + 5{\cdot}469/c^2)w + (-28{\cdot}38 + 32{\cdot}42/c - 3{\cdot}386/c^2)w^2$, which applies to solutions having the concentration of the water, $w = 0{\cdot}02 - 1{\cdot}3$, and that of the hydrogen chloride, $c = 0{\cdot}16 - 0{\cdot}66$.

The introduction of the nitro-group into cinnamic acid accelerates the esterification to the smallest extent in the *m*-, and in the *o*- probably to a greater extent than in the *p*-position. At 25°, one litre of 99·97% alcohol dissolves 0·0107 gram-mol. of the *o*-, 0·0519 gram-mol. of the *m*-, and 0·0050 gram-mol. of the *p*-nitro-acid. G. Y.

Esterification of *p*-Mandelic Acid and Benzoylformic Acid. Anton Kailan (*Monatsh.*, 1907, **28**, 1187—1209. Compare preceding abstract).—The velocity of esterification of mandelic acid by means of hydrogen chloride and alcohol at 25° increases approximately proportionally to the concentration of the hydrogen chloride if not more than traces of water are present, but more rapidly than the hydrogen chloride concentration in presence of much water. As ethyl mandelate is hydrolysed on titration with baryta, the method employed for the study of the velocity of esterification has in this case been modified by the use of ammonia instead of baryta for the titrations. The relation between the velocity constant and the concentrations of the water and hydrogen chloride are expressed by the equation: $1/k = 0{\cdot}0999 + 0{\cdot}1508/c - 0{\cdot}003324/c^2 + (-0{\cdot}2073 + 0{\cdot}04395/c + 0{\cdot}1236/c^2)w + (-0{\cdot}7412 + 1{\cdot}017/c - 0{\cdot}0619/c^2)w^2$, which applies to solutions having $w = 0{\cdot}01 - 1{\cdot}3$ and $c = 0{\cdot}16 - 0{\cdot}71$. The constant for the velocity of esterification for mandelic acid in alcohol in absence of a catalyst increases with the mandelic acid concentration if calculated by means of the equation for unimolecular reactions, but decreases if calculated for a bimolecular reaction. It is shown, also, that, in absence of a catalyst, the addition of water has little effect on the velocity of esterification.

The constant of velocity of esterification of benzoylformic acid could be determined only approximately, as the ester is partially hydrolysed on titration with either baryta or ammonia; the results obtained show that the presence of a carbonyl group in the α-position has a much greater retarding influence on the esterification by means of hydrogen chloride and alcohol than has an α-hydroxyl.

The simultaneous esterification of benzoic and cinnamic acids by means of hydrogen chloride and alcohol has been studied. It is found that these two acids do not interfere with the velocity of esterification of each other. G. Y.

Action of Normal Salts. Rudolf Höber (*Beitr. chem. Physiol. Path.*, 1907, **11**, 35—64).—An examination of the effect of normal salts on the precipitation of egg-albumin, serum-albumin, and lecithin, and on the catalysis of methyl and ethyl acetates by acid and by alkali. The results obtained by catalysis are quite regular; for instance, the chlorides of the alkali metals accelerate the acid catalysis in the order of their atomic weights, LiCl being most, and CsCl least, active. The same applies to alkaline catalysis, except that the effect is a retardation, so that the order is reversed, the series becoming

$$\mathrm{Li} < \mathrm{Na} < \mathrm{K} < \mathrm{Rb} < \mathrm{Cs}.$$

The same applies to anions: in acid solution, $SO_4 < Cl < Br < I$; in alkaline solution, $I < Br < Cl < SO_4$.

These generalisations can be extended to the precipitation in colloidal systems, provided the reaction of the medium is either distinctly acid or distinctly alkaline, the reversal of the reaction again bringing about reversal of the series. In neutral solution, however, the order of efficiency as precipitants becomes irregular, and depends simultaneously on both ions; for instance, egg-albumin is more readily precipitated by rubidium than by sodium when present as chloride, but less readily when present as sulphate. G. B.

Catalysis. JULIUS STIEGLITZ (*Amer. Chem. J.*, 1907, **38**, 743—746).—It is claimed that the theory of catalysis put forward by Acree (Abstr., 1907, ii, 855) was first enunciated by the author in a paper published in 1904 (*Report Congress Arts and Sciences, St. Louis*, **2**, 276—284). T. A. H.

Catalysis. VI. Bromination. SALOMON F. ACREE, J. M. JOHNSON, and SIDNEY NIRDLINGER (*Amer. Chem. J.*, 1907, **38**, 746—748).—In view of the publication of a note by Cohen and Cross on the bromination of acylamino-compounds (Proc., 1907, **23**, 148), it is pointed out that the authors have been engaged in the investigation of such catalytic actions, and have discussed the processes by which they occur (Abstr., 1907, i, 506, 855), and that the isolation by Cohen and Cross of the intermediate compound, $C_6H_4Me\cdot NHBr_2Ac$, formed in the bromination of acetyl-*p*-toluidide, affords a confirmation of their views. One of the authors (Nirdlinger) has prepared the related substance, $C_6H_5\cdot NMeBr_2Ac$, in an impure state. T. A. H.

Use of a Vacuum for Drying Salts Containing Water of Crystallisation. FRIEDRICH KRAFFT (*Ber.*, 1907, **40**, 4770—4774). —A study of the behaviour of salts containing water of crystallisation in the vacuum of the cathode light, and a comparison of the results obtained with those originally observed by Graham (*Phil. Mag.*, 1835, [iii], **6**, 333). It is shown that there is no essential difference between the so-called water of constitution and water of crystallisation, the former is lost in vacuum, but it requires a very much longer time. Barium oxide in powder is the drying agent generally employed, as sulphuric acid volatilises in this vacuum. The rate in which the water is eliminated depends on the state of division of the salt, the vacuum employed, and the temperature.

Zinc sulphate, $ZnSO_4,7H_2O$, lost $6H_2O$ in summer during fifteen hours; in another experiment, sixty hours were required with larger crystals; the seventh molecule was only withdrawn after three weeks. In order to eliminate the last molecule quickly in vacuum, a temperature of 210° is necessary.

In the case of magnesium sulphate, a very finely-powdered specimen lost $6H_2O$ in fifteen hours, but the last molecule requires two hours' heating at 230° before expulsion. Graham stated that this salt retained $2\frac{1}{4}H_2O$ in vacuum over sulphuric acid; using barium oxide, instead, but otherwise adhering to Graham's conditions, during three weeks over 6 mols. were abstracted.

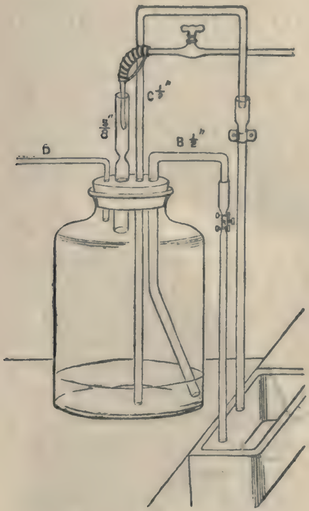
Ferrous, nickel, and cobalt sulphates lose $6H_2O$ during forty-five hours; the seventh molecule is eliminated at 280°. Copper sulphate,

$CuSO_4,5H_2O$, loses $4H_2O$ in a moderate vacuum over sulphuric acid in sixty hours; over barium oxide, more than $4\frac{1}{2}H_2O$ in ten days.

The loss of water from gypsum, $CaSO_4,2H_2O$, is scarcely noticeable at the ordinary temperature; at 100°, 1½ mols. are lost, whilst at 150° the two are eliminated (compare Davis, Abstr., 1907, ii, 686).

The elimination of water from potassium alum is hastened in vacuum, and the following salts are quickly and completely dehydrated: sodium sulphate, sodium thiosulphate, manganese ammonium sulphate, copper chloride, strontium chloride, disodium hydrogen phosphate, sodium acetate, lead acetate, zinc lactate. W. R.

A Simple Water-jet Blower. S. M. Revington and J. G. Rankin (*Chem. News*, 1907, **96**, 259—260).—A large bottle of about 4 litres capacity is fitted with a cork carrying four tubes, *a*, *b*, *c*, *d*, the diameters of which are ⅝″, ½″, ⅜″, and ¼″ respectively. The tube *a*, which passes just through the cork, has a sudden constriction immediately above the cork; into this tube, the water supply is delivered in such a way that the jet goes diagonally across the tube on to the side of the constricted part. The tube *b* is a syphon outlet reaching to the bottom of the bottle, and delivering into the sink at the other end; it is provided with a clip to regulate the outfall. The tube *c*, 2′5″ in height, is a safety tube reaching nearly to the bottom of the bottle, and discharging at its upper bent end into a wide tube leading to the sink. The air blast is delivered through *d*, which passes just through the cork. To work the apparatus, the tube *d* is closed, and the water supply turned on; the pressure first starts the syphon and then air and water escape through *c*, and the pressure quickly reaches a maximum. The tube *d* is now opened, when a steady blast of air is produced, which can be maintained for an indefinite time by regulating the water-jet and the clip so that the water does not rise in the bottle.



C. S.

Lecture Experiments with Inorganic Nitrogen Compounds. Fritz Raschig (*Ber.*, 1907, **40**, 4580—4588).—The author gives details of a number of lecture experiments to illustrate the preparation of various inorganic nitrogen compounds which have been described previously. Amongst the compounds in question, are salts of nitrilosulphonic acid, $N(SO_3H)_3$, hydroxylaminedisulphonic acid, $OH{\cdot}N(SO_3H)_2$, nitrosodisulphonic acid, $NO(SO_3H)_2$, nitrososulphonic acid,

$$OH{\cdot}NO{\cdot}SO_3H,$$

pernitric acid, HNO_4, and chloroamine, NH_2Cl (*Chem. Zeit.*, 1907, 31, 126). The formation of hydrazine from ammonia and chloroamine is also described.

The yellow potassium nitrosodisulphonate, which yields violet solutions, is readily obtained by oxidising sodium hydroxylaminedisulphonate with ammoniacal potassium permanganate, filtering from manganese dioxide, and adding potassium chloride. A. McK.

Inorganic Chemistry.

The Development of Inorganic Chemistry in the last Forty Years. Hans Landolt (*Ber.*, 1907, **40**, 4627—4637).—A lecture delivered before the German Chemical Society. W. H. G.

Activity of the Halogens: Chlorine, Bromine, and Iodine in Relation to Mercury. M. C. Schuyten (*Chem. Zeit.*, 1907, **31**, 1135. Compare Abstr., 1896, ii, 524).—Even in the presence of an excess of the salt, the halogen in mercuric chloride, bromide, or iodide may be replaced by either of the other halogens, the only exception being the action of iodine on mercuric bromide; in this case, no bromine is displaced by the iodine. W. H. G.

New Polymorphous Form of Iodine. W. A. Kurbatoff (*Zeitsch. anorg. Chem.*, 1907, **56**, 230—232).—When solutions of iodine in various solvents are evaporated to crystallisation, the element separates either as rhombic plates or as dendritic aggregates. The separation of a definite, crystalline form does not depend on the colour of the solution, but on the temperature, the common, rhombic, crystals being obtained at the higher temperatures. The transition temperature could not be determined by the usual thermal method, as there was no break in the cooling curve of iodine from 100—0°, but was established approximately by condensation on a glass surface kept at different temperatures; below 46—47°, the dendritic crystals were obtained, at higher temperatures the rhombic modification. G. S.

Action of Iodine on some Elements in Vacuum. Marcel Guichard (*Compt. rend.*, 1907, **145**, 807—808).—When a tube containing iron wire and iodine, separated by an asbestos plug, is evacuated, sealed, and heated in such a manner that the iron is kept at 500° and the iodine at 180°, ferrous iodide is formed and sublimes in the form of deep red crystals. Uranium and nickel also form iodides under similar conditions, the former as dark grey lamellæ. In the case of very volatile iodides, such as those of aluminium and silicon, it is necessary to keep the three portions of the tube (bent so that the middle portion is horizontal and the others pointing slightly downwards) at three different temperatures, the iodine at one end at 180°, the metal in the middle at 500°, and the other end (to receive the iodide) at 15°. Otherwise the iodide formed remains mixed with the iodine vapour and retards the action. E. H.

Amorphous Sulphur. V. The System Sulphur–Iodine. Alexander Smith and Charles M. Carson (*Zeitsch. physikal. Chem.*, 1907, **61**, 200—208. Compare Abstr., 1906, ii, 157; 1907, ii, 20).—The proportion of S_μ in the equilibrium mixture of S_λ and S_μ at a given temperature is raised by the addition of iodine. Thus, at 150° and in the absence of iodine, the percentage of S_μ in the equilibrium mixture is 6·7; when one part of iodine is present per one hundred parts of sulphur, the percentage of S_μ is 12·26; when five parts of iodine are present per one hundred parts of sulphur, the percentage of S_μ is 17·86. The effect of the presence of two parts of iodine per one hundred parts of sulphur at different temperatures is shown in the following table:

Temperature		150°	165°	220°	310°	448°
Percentage of insoluble sulphur	without iodine	6·7	14·0	29·4	32·6	34·1
	with iodine	13·8	24·1	47·0	54·2	62·7

A study of the freezing points of mixtures of sulphur and iodine shows that neither compounds nor solid solutions are formed (compare Boulouch, Abstr., 1903, ii, 538).

The authors reply to Hoffmann and Rothe (Abstr., 1907, ii, 539).

J. C. P.

Electro-Syntheses. Sima M. Losanitsch (*Ber.*, 1907, **40**, 4656—4666).—An investigation of the behaviour of various substances in a gaseous form, both when alone and mixed together, under the influence of a silent electric discharge. The apparatus and method employed have been described (Abstr., 1897, i, 179).

Sulphur dioxide is converted into sulphur trioxide with liberation of sulphur; in the presence of hydrogen or hydrogen sulphide, water is formed and sulphur liberated. Nitric oxide yields nitrogen and nitrogen peroxide; when mixed with hydrogen, it is reduced to nitrogen, the latter interacting with the water formed, yielding ammonium nitrite. A mixture of nitric oxide and hydrogen sulphide yields an aqueous solution of ammonium polysulphide.

Carbon disulphide vapour is converted into a *polymeride*, $(CS_2)_n$, an almost black substance, which decomposes into its components when strongly heated. A mixture of carbon disulphide and hydrogen or hydrogen sulphide yields a brown *substance*, $C_3H_2S_6$, previously inaccurately described as a polymeride of carbon monosulphide, $(CS)_n$ (*loc. cit.*), and by Berthelot (Abstr., 1899, i, 657) as a substance having the composition $C_2H_2S_4$. Carbon disulphide yields with carbon monoxide a brown, insoluble *substance*, $3CS_2,2CO$; with ethylene, a brownish-yellow, insoluble *substance*, $5CS_2,2C_2H_4$; with acetylene, an almost black, insoluble *substance*, $3CS_2,2C_2H_2$.

Acetylene alone is converted into a viscid or solid mass containing (1) a fragrant, viscid *substance*, soluble in alcohol and ether, which rapidly absorbs oxygen from the air, forming a *substance*, $(3C_2H_2,C_2H_4,O)_5$;

(2) an insoluble *substance*, $C_{48}H_{46}$, yellowish-brown by reflected and yellowish-red by transmitted light, having an empyreumatic odour; it absorbs oxygen, forming the *substance*, $C_{48}H_{46}O_8$. These acetylene condensation products decompose at 100°; they also evolve an emanation, which liberates iodine from potassium iodide and produces a reducing action through aluminium or gold leaf on a photographic plate; the emanation is not a radioactive emanation, the action produced being probably due to absorbed oxygen present in a labile state. The same substances are produced together with polymerised acetaldehyde when water is present with the acetylene. Equal volumes of acetylene and hydrogen or methane give a clear yellow product, containing a viscid liquid, soluble in ether, and an insoluble solid, of the formulæ C_6H_{10} and C_6H_8 respectively. Equal volumes of acetylene and ethylene yield (1) a *substance*, C_2H_2,C_2H_4, obtained as a red, viscid, fragrant liquid; (2) a solid *substance*, $3C_2H_2,C_2H_4$, insoluble in all solvents, and decomposing when heated. Equal volumes of acetylene and hydrogen sulphide yield (1) a yellow *substance*, $C_8H_{14}S_2$, soluble in ether; (2) a yellow *substance*, $C_{10}H_{14}S_4$, insoluble in ether. Acetylene with carbon monoxide yields a yellowish-brown, insoluble *substance*, which absorbs oxygen rapidly, forming a *substance*, $4C_2H_2,CO,O_2$. Equal volumes of acetylene and sulphur dioxide condense with the formation of a dark brown, insoluble *substance*, C_2H_2OS.

Ethylene is converted into a yellowish-red, oily *substance*, soluble in alcohol; it absorbs oxygen, forming a viscid *substance*, $(C_{12}H_{22}O)_2$. Equal volumes of ethylene and methane yield a clear, yellow, viscid liquid, which absorbs oxygen, forming a viscid *substance*, $C_{22}H_{42}O_4$. Ethylene and hydrogen sulphide yield a *substance*, $(C_2H_4S)_6$, obtained as a viscid, yellowish-red liquid. It is probable that ethyl mercaptan is first formed, since this compound yields the same substance under the influence of a silent discharge. Ethylene and carbon monoxide yield (1) a *substance*, $(2C_2H_4,CO)_2$, obtained as a yellowish-red, viscid liquid, soluble in ether, &c.; (2) an insoluble *substance*, $(2C_2H_4,CO)_n$.

W. H. G.

Atomic Weight of Tellurium. Willy Marckwald (*Ber.*, 1907, 40, 4730—4738).—Although both Staudenmaier and Mylius had drawn the conclusion from a series of fractional crystallisations that telluric acid is a uniform substance, these authors had not sufficiently considered the possibility of their having dealt with an isomorphous mixture which could be separated only by a systematic method of crystallisation. The author accordingly examined about 1500 grams of telluric acid from the latter standpoint, and, after several hundred crystallisations, obtained twenty fractions of about equal weights; between the first and last fractions, there was not, however, the slightest difference. There is no doubt as to the uniformity of tellurium.

For the determination of the atomic weight of tellurium, the author has modified the method of Staudenmaier, namely, the conversion of telluric acid into tellurium dioxide (Abstr., 1896, ii, 97).

Crude tellurium, obtained from the Selmeczbanya mines, was converted into dioxide and separated from copper, lead, silver, &c.

The dioxide was then oxidised to telluric acid by means of chromic acid, and submitted to a prolonged series of crystallisations from water. The telluric acid used in the determinations was dried over phosphoric oxide in a vacuum. It is worthy of note that, when telluric acid is exposed over phosphoric oxide for two months in a vacuum, it remains practically constant in weight.

The method is based on the action as represented by the equation: $H_6TeO_6 = TeO_2 + O + 3H_2O$. The heating was conducted in a platinum vessel by means of an electrical oven, the temperature at the bottom of the vessel being measured through a Le Chatelier element by means of a millivolt meter. The temperature at the top of the platinum vessel was maintained lower than that at the bottom, in order to guard against volatilisation of the dioxide. The temperature was gradually raised in the course of two to three hours from 100° to 160°, and then gradually in the course of three to four hours more to 650°, which temperature was maintained for another hour. The residue was always white, and quite free from the trioxide. The weight did not alter on further heating for one hour.

The various precautions taken are indicated.

As a mean of six experiments, the value 126·85($\pm$0·02) was obtained on the basis of O = 16 and H = 1·008. This value is lower than that of iodine (I = 126·97). A. McK.

Catalytic Synthesis of Ammonia from its Elements. Léon Brunel and Paul Woog (*Compt. rend.*, 1907, **145**, 922—924. Compare Woltereck, Abstr., 1904, ii, 115).—Attempts to effect the synthesis of ammonia by passing a mixture of pure hydrogen (3 vols.) and nitrogen (1 vol.) over a mixture of thorium and cerium oxides, palladinised pumice, quicklime, soda lime, calcium chloride, calcium molybdate, anhydrous barium or strontium oxide, manganese dioxide, aluminium phosphate, or magnesium phosphate at 15° to 350° were unsuccessful. The gaseous mixture reacts with nickel sesquioxide at 180° to 200° to form water and a trace of ammonia, but the reaction is fugitive. If, however, a mixture of air and excess of hydrogen is passed over heated nickel sesquioxide, the latter is alternately reduced and reoxidised, and the energy liberated by the reactions causes the formation of small quantities of ammonia; the reaction is continuous, provided that the nickel oxide is not allowed to become incandescent owing to the heat of the reaction. This is effected by suspending the tube containing the nickel oxide in a bath of petroleum, b. p. 200—240°. M. A. W.

Boiling Point of Liquid Ammonia. Edward C. Franklin (*Ann. Physik*, 1907, [iv], **24**, 367—369).—A critical review of the determinations made by de Forcrand (*Ann. Chim. Phys.*, 1903, [vii], **28**, 537), Gibbs (Abstr., 1905, ii, 570), Perman and Davies (Abstr., 1906, ii, 743), and Brill (Abstr., 1906, ii, 847) leads the author to the conclusion that Gibbs' value (−33·46°) is probably correct to within 0·1°. J. C. P.

Formation of Nitric Oxide in High Tension Arcs. Fritz Haber and Adolf Koenig (*Zeitsch. Elektrochem.*, 1907, **13**, 725—743).—An alternating current was passed through mixtures of oxygen and nitrogen under pressures varying from about 40 mm. to 200 mm. Electrodes of platinum, oxidised iron, and Nernst glowers were used. The gas was passed through water-cooled tubes of hard glass or quartz of 5 to 7 mm. bore, along the axis of which the discharge passed. At the lower pressures, the whole mass of gas in the tube glowed with a pink light, with the exception of a thin film next to the wall of the tube; at the higher pressures, the glowing column of gas tended to contract further from the walls. The best results are obtained when the gas does not flow over the electrodes, and when the latter are very hot. Electrodes of iron or Nernst filaments give the best results. The percentage of nitric oxide in the gas increases with the current up to a maximum which is not affected by further increase of current. The greatest concentration of nitric oxide is obtained with gas at 100 mm. pressure. The maximum percentage of nitric oxide obtained with each mixture was (at 100 mm.):

Percentage of oxygen in mixture	20·9	48·9	44·4	75·0	81·7
Pencentage of nitric oxide	9·8	14·4	14·3	12·77	12·1

Assuming that the formation of nitric oxide is a purely thermal phenomenon and using Nernst's determinations of the equilibrium concentrations, these results indicate that the temperature of the gas in the path of the arc was between 4300° and 5000° absolute.

From the thickness of the non-luminous film of gas between the luminous gas and the walls of the vessel, the authors calculate that the temperature of the hot gas could not have exceeded 3000°; further, the rate of cooling of the gas was small, so that nitric oxide formed by very high temperature alone would probably have been decomposed. The authors incline rather to believe that the temperature was low, and the high percentage of nitric oxide found was produced by collisions of electrons; owing to the low temperature, the nitric oxide thus formed escaped decomposition, which is not the case in the hotter flames produced in gases under atmospheric pressure. T. E.

Non-existence of a Common Solvent for White and Red Phosphorus. Albert Colson (*Compt. rend.*, 1907, **145**, 1167—1168).—Schroetter stated that red phosphorus is soluble in oil of turpentine; this statement has been contested, and the author shows that pure red phosphorus does not dissolve in oil of turpentine or in the polymerised products obtained by the action of heat on the solvent, even when heated at 270° in a sealed tube, provided that air is excluded. Further, red phosphorus is not altered when heated at 275—285° in a sealed tube containing a solution of phosphorus in turpentine.

There exists, moreover, no common solvent for white and red phosphorus, for Lemoine has shown that the two varieties have the same vapour density, corresponding with the molecule P_4; according to van't Hoff's hypothesis, therefore, the two varieties would become identical in a common solvent. M. A. W.

Action of Hydrogen Phosphide on Mercuric Chloride or Bromide, PHg_3Cl_3 and $P_2Hg_5Br_4$. Paul Lemoult (*Compt. rend.*, 1907, **145**, 1175—1177).—H. Rose (*Pogg. Ann.*, 1837, 40, 75, 87) obtained a yellow, amorphous compound, $PHg_3Cl_3,1\frac{1}{2}H_2O$, by the action of hydrogen phosphide on mercuric chloride, and an analogous compound of a brown colour when mercuric bromide replaced the mercuric chloride. The author finds, however, that mercuric chloride gives with hydrogen phosphide the anhydrous compound PHg_3Cl_3, whereas mercuric bromide forms the *compound*, $P_2Hg_5Br_4$, according to the equations: I. $PH_3 + 3HgCl_2 = 3HCl + PHg_3Cl_3$; II. $2PH_3 + 5HgBr_2 = 6HBr + P_2Hg_5Br_4$. The presence of excess of hydrogen phosphide, even locally, as when the gas is bubbled through a solution of the mercuric halide, leads to a reduction of the salt with liberation of mercury, and the best results are obtained when an aqueous solution of hydrogen phosphide is carefully poured on to the surface of a concentrated solution of the mercuric halide and the corresponding potassium salt and the mixture suddenly shaken; the precipitate thus obtained is uniform in colour and of constant composition.

M. A. W.

Action of Arsine on Solutions of some Metallic Salts. Hans Reckleben, Georg Lockemann, and Alfred Eckardt (*Zeitsch. anal. Chem.*, 1907, **46**, 671—709).—Arsine is absorbed rapidly and completely by silver nitrate solution, but slowly by mercury, copper, lead, tin, and iron salt solutions; the latter solutions are useless for the quantitative absorption of arsine. The reaction with silver nitrate solution does not take place exactly according to Lassaigne's equation: $AsH_3 + 6AgNO_3 + 3H_2O = H_3AsO_3 + 6Ag + 6HNO_3$, but, in part, according to the equation: $AsH_3 + 3AgNO_3 = Ag_3As + 3HNO_3$. The silver arsenide is not very stable in the presence of the nitric acid, and further action takes place: $Ag_3As + 3AgNO_3 + 3H_2O = H_3AsO_3 + 6Ag + 3HNO_3$. In dilute ammoniacal silver nitrate solution, three reactions take place consecutively or simultaneously: (*a*) $AsH_3 + 3(AgNH_3)NO_3 = Ag_3As + 3NH_4NO_3$, (*b*) $Ag_3As + 3(AgNH_3)NO_3 + NH_4OH + H_2O = NH_4AsO_2 + 6Ag + 3NH_4NO_3$, and (*c*) $NH_4AsO_2 + 2(AgNH_3)NO_3 + 2NH_4OH = (NH_4)_3AsO_4 + 2Ag + 2NH_4NO_3$. Metallic arsenic, when warmed with ammoniacal silver nitrate solution, is oxidised, thus: $As + 5(AgNH_3)NO_3 + 3NH_4OH + H_2O = (NH_4)_3AsO_4 + 5Ag + 5NH_4NO_3$. In ammoniacal solution and in the presence of air, arsine is readily oxidised. It is also mentioned in the paper that finely-divided silver is not attacked by 6·3% nitric acid within four hours at the ordinary temperature, and *N*/10 nitric acid is only very slowly reduced at the ordinary temperature by arsenious acid.

W. P. S.

Compounds of Arsenic Sulphates with Potassium, Calcium, and Lead Sulphates. Hugo Kühl (*Arch. Pharm.*, 1907, **245**, 377—379).—The crystalline compounds: $2K_2O,As_2O_3,4SO_3$,

$CaO,As_2O_3,3SO_3$,

$PbO,As_2O_3,2SO_3$ were obtained by dissolving arsenious oxide and potassium, calcium, or lead sulphate in concentrated sulphuric acid and driving off sulphuric acid by heating; with strontium and barium sulphates, similar compounds could not be obtained.

C. F. B.

Identity of Graphite and "Temper" Graphitic Carbon in Cast Irons. GEORGES CHARPY (*Compt. rend.*, 1907, **145**, 1173—1174).—It was stated by Forquignon and Ledebur that the carbon (graphite) contained in cast iron that has been cooled gradually, differs from the carbon ("temper" carbon) that separates in rapidly-cooled cast iron, in that the latter is volatile and the former non-volatile when a stream of hydrogen or nitrogen is passed over the red-hot cast iron. Wüst and Geiger find, however (Abstr., 1906, ii, 88), that pure hydrogen or nitrogen is without action on "temper" carbon or on graphite. The author has, therefore, examined the chemical behaviour of the free carbon obtained from two portions of cast iron, one of which had been gradually, the other rapidly, cooled, and the results show that graphite and the so-called "temper" carbon are identical both with regard to the velocity with which they are oxidised to graphitic acid and to the rate at which they are completely eliminated in the gaseous form when a stream of pure hydrogen is passed over the cast iron at 1000°.

M. A. W.

Solubility of Potassium Iodide in Water, and of Water in Potassium Iodide at Low Temperatures. ROBERT KREMANN and F. KERSCHBAUM (*Zeitsch. anorg. Chem.*, 1907, **56**, 218—222).—Meusser (Abstr., 1905, ii, 317) has recently determined the complete solubility curves for water with potassium chloride and bromide respectively, and found no evidence of the formation of hydrates, but in the case of water and potassium iodide there was a break in the observations from 42·7% to 53·5% of the salt, the eutectic point being determined by extrapolation. The authors have now determined the complete curve, including observations within the limits indicated, and find no evidence of chemical combination; the eutectic point lies at −23·1°, the mixture containing 52·2% by weight of potassium iodide.

G. S.

Waterglass. VI. JOHN M. ORDWAY (*Amer. J. Sci.*, 1907, [iv], **24**, 473—478).—In an earlier paper (*Amer. J. Sci.*, 1865, **40**, 190), it has been shown that when alcohol is added to solutions of sodium and potassium silicates, basic silicates are precipitated.

On mixing strong solutions of sodium silicate and lithium chloride, precipitates are produced containing varying quantities of lithium and sodium silicates. By re-dissolving these precipitates and adding lithium chloride to the solutions, the proportion of lithium in the product can be gradually increased, but pure lithium silicate cannot be obtained in this manner. When, however, freshly-prepared silica is digested with lithium hydroxide solution at the ordinary temperature, a solution of lithium silicate, Li_2SiO_3, is produced. On heating this solution, a precipitate is produced which re-dissolves on cooling.

Soluble rubidium silicates can be obtained of composition varying from Rb_2O,SiO_2 to $2Rb_2O,9SiO_2$. In the case of the lithium silicates, the range is not so great.

When ammonia is added to a solution of a silicate containing a large proportion of silicic acid, a precipitate is usually produced.

E. G.

Ammonium Amalgam. G. McPhail Smith (*Ber.*, 1907, **40**, 4893. Compare Abstr., 1907, ii, 615).—A reply to the criticisms of Travers (Abstr., 1907, ii, 865). It is argued that ammonium amalgam is completely analogous to sodium and potassium amalgams, which are regarded as solutions of $NaHg_n$ or KHg_n in mercury.

E. F. A.

Amalgams. The Hydrargyrides of the Alkali and Alkaline Earth Metals. G. McPhail Smith (*Amer. Chem. J.*, 1907, **38**, 671—683).—Further evidence in favour of the views expressed regarding the nature of amalgams in previous papers (Abstr., 1905, ii, 164, 450; 1906, ii, 673; 1907, ii, 462, 463, 615) is brought forward, and it is shown that, unlike the amalgams of the alkaline earth metals, those of the common alkali metals do not increase in stability with increase in the atomic weight of the alkali metal used (the order of stability being: Li, K, Na). The amalgams used were liquid, and were prepared by electrolysing a solution of the chloride of the appropriate metal in presence of mercury.

The relative stabilities of the amalgams were tested (1) by the rate of decomposition on exposure to air, (2) by the capacity for decomposing water, (3) by the rapidity with which they were decomposed by ammonia solution, and (4) by the composition of the equilibrium amalgam obtained when the amalgam under investigation was acted on by an aqueous solution of sodium chloride and the chloride of its own metal.

By all four methods of investigation, it was found that the relative stabilities of the amalgams examined increased in the following order: K, Rb, Cs. The mercury compound of lithium is the least stable in the alkali metal group, whilst that of sodium is the most stable. Sodium amalgam also behaves in an exceptional manner; thus, on exposure to air, no sodium peroxide is formed, whereas the corresponding peroxide is formed in each case when an amalgam of potassium, rubidium, or cæsium is exposed to air. The metals of the pairs, Cs,Na and Rb,Na, are, like most of the other metals of the alkali and alkaline earth groups, reversibly displaceable in aqueous solution in presence of mercury.

T. A. H.

Artificial Reproduction of Barytes, Celestine, and Anglesite, and Isomorphous Mixtures of these Substances. Paul Gaubert (*Compt. rend.*, 1907, **145**, 877—879).—Behren's microchemical reaction for the detection of certain metals (Abstr., 1886, 917; 1891, 766) gives confused results in the cases of barium and strontium. By a modification of the method, the author has obtained crystals of the sulphates of barium, strontium, lead, or calcium similar to those of the natural minerals, and of such dimensions that the optic axial angles, which are characteristic for each substance, could be measured. The method consists in evaporating to dryness 100 c.c. of a saturated sulphuric acid solution of the metallic sulphate at the boiling point, or at a slightly lower temperature, and in the case of barium or strontium sulphate the crystals thus obtained were sufficiently large to admit of goniometrical measurement. Mixed crystals of barium and strontium sulphate, or of either of these sulphates with that of lead, were prepared similarly. Calcium sulphate, not being isomorphous with the preceding sulphates, does not form with them mixed crystals, although the crystal forms of these sulphates are modified by the presence of calcium sulphate in the solution. M. A. W.

Colloidal and Gelatinous Calcium and Magnesium Compounds. Carl Neuberg [and, in part, B. Rewald] (*Sitzungsber. K. Akad. Wiss. Berlin*, 1907, 820—822. Compare Neuberg and Neimann, Abstr., 1906, ii, 753).—Calcium sulphate, calcium phosphate, and calcium oxalate are precipitated in a gelatinous form when sulphuric acid, phosphoric acid, and oxalic acid respectively are added to a methyl-alcoholic solution of calcium oxide. The clear, viscous, colloidal solution of calcium carbonate, obtained by passing a stream of carbon dioxide into a methyl-alcoholic solution of calcium oxide, may be evaporated, without undergoing decomposition, to a thick liquid which sets to a jelly. If a current of carbon dioxide is passed into a suspension of calcium oxide in methyl alcohol, the liquid after about five to six hours is transformed into a solid jelly, which dissolves slowly in methyl alcohol. The colloidal calcium carbonate is miscible with several organic solvents, for example, benzene, chloroform, and ether.

Analogous colloidal magnesium compounds may be similarly prepared from a methyl-alcoholic solution of magnesia.

Analysis of the isolated gelatinous salts (sulphate, phosphate, and oxalate) of calcium and magnesium showed that they did not contain combined methyl alcohol. W. H. G.

The Autoreduction of some Metallic Oxides in the Vacuum of the Cathode Light and on the Volatility of the Corresponding Sulphides. F. Damm and Friedrich Krafft (*Ber.*, 1907, **40**, 4775—4778).—The behaviour of oxides when heated is sometimes quite otherwise in a vacuum than under ordinary pressure. Thus cadmium oxide at 1000° decomposes into oxygen and cadmium, whereas in air it is completely stable. The experiments were carried out in quartz tubes heated in a Heraeus electric oven.

At 750°, lead oxide gives a metallic mirror, and bismuth oxide decomposes slowly at 650°.

Antimony oxide, volatile at about 700°, is not completely decomposed at 1050°. It is conjectured that the autoreduction of the common metals may proceed in stages like that of antimony, consisting (1) of simultaneous oxidation and reduction:

$$4Sb_4O_6 = 3Sb_4O_8 + 4Sb_4,$$

and (2) conversion of a higher oxide into a lower.

The sulphides are more volatile than the corresponding oxides, cinnabar sublimes at 400° and cadmium sulphide very quickly at 770—780°, whereas lead sulphide volatilises at 600°; the sulphides of bismuth, antimony, and arsenic sublime at 740°, 530°, and 230° in the vacuum of the cathode light.

It is possible to separate by distillation, mixtures of arsenic and antimony sulphides or mercury and lead sulphides under those conditions, as well as sulphur, selenium, and tellurium.

The suphides of copper, tin, and silver are decomposed; the first two lose half their sulphur content, and the last is converted into metal and sulphur. W. R.

Solubility of Certain Lead Compounds in Water. Max Pleissner (*Chem. Zentr.*, 1907, ii, 1055—1056; from *Arb. Kais. Gesundh.-Amt*, 1907, **26**, 384—443).—This investigation was undertaken in connexion with the risk of contamination of water supplies by lead. Lead oxide and hydroxide, and the normal and basic carbonates, sulphates, and chlorides have been studied.

When hot solutions of lead salts are treated with alkali hydroxides, lead oxide, PbO, is precipitated, whilst from cold solutions, hydrated oxides separate. The lead oxide forms greyish-yellow scales with a metallic lustre, and gives a greenish-yellow powder. The same oxide is produced by the action of water containing much dissolved oxygen on lead, whilst by the action of water containing but little oxygen the hydrates are formed. A *hydrate*, $Pb_3O_2(OH)_2$, has been identified, but higher hydrates probably exist, the solubility increasing with the degree of hydration. The oxide and its hydrates appear to dissociate, thus: $Pb(OH)_2 \rightleftharpoons Pb(OH)^{\cdot} + OH'$, the degree of dissociation in a solution saturated at 18° amounting to about 25%. The solubility of lead sulphate and chloride in water is diminished by the presence of sulphuric or hydrochloric acid, whilst that of the carbonate is increased by the presence of carbonic acid.

The following basic lead salts have been obtained, and their individuality established by application of the phase rule. *⅓-Basic lead carbonate*, $PbO,2PbCO_3,H_2O$; *½-basic lead sulphate* and *chloride*, $PbO,PbSO_4$ and $PbO,PbCl_2,H_2O$; *¾-basic lead sulphate* and *chloride*, $3PbO,PbSO_4,H_2O$ and $3PbO,PbCl_2,H_2O$. These salts are less soluble in water than the corresponding normal salts.

The solubility (millimols. Pb per litre) and the specific conductivity of the saturated solutions, after deducting the value for the conductivity of the water, are as follows at 18°:

	PbO	$Pb_3O_2(OH)_2$	$PbCO_3$	$Pb_3(CO_3)_2(OH)_2$	$PbSO_4$
Solubility	0·31	0·45	0·0002	<0·0002	0·126
Specific conductivity	19·5	27·3	—	—	33·9

	$Pb_2O(SO_4)$	$Pb_4O_2(OH)_2(SO_4)$	$PbCl_2$	$PbCl_2(OH)_2$	$Pb_4Cl_2O_2(OH)_2$
Solubility	0·050	0·106	33·6	0·38	0·10
Specific conductivity	8·8	9·3	4512	68	19

E. G.

Aluminium Titanide. Wilhelm Manchot and P. Richter (*Annalen*, 1907, **357**, 140—144. Compare Manchot and Fischer, this vol., ii, 46).—Attempts to prepare double aluminium titanides with the object of investigating the capacity of titanium to form chains have resulted only in the formation of aluminium titanide,

Al_3Ti (Wöhler, *Annalen*, 1860, **113**, 248; **115**, 108). The titanide is best prepared by fusing 24 parts of potassium titanofluoride with 45·5 parts of aluminium, and gently heating the regulus with dilute sodium hydroxide. The product forms silver-white leaflets, D 5·5, is brittle, hardly scratches steel, glass, or fluorspar, contains tervalent titanium, since it forms a blue solution in hot dilute sulphuric acid, evolving twelve atomic proportions of hydrogen, and evolves thirteen atomic proportions of hydrogen when dissolved in aqueous potassium hydroxide. The titanide may have the double formula, $Al_3Ti{\cdot}TiAl_3$, but this cannot be decided. G. Y.

Manganese and the Periodic Law. Henry Reynolds (*Chem. News*, 1907, **96**, 260).—The author considers that manganese, which shows only the slightest resemblance to the halogens, should be placed in the eighth group with iron, nickel, and cobalt. It resembles these metals in physical properties, and in the formation of similarly constituted and isomorphous simple and double salts, $M''SO_4,7H_2O$ and $R_2SO_4,M''SO_4,6H_2O$, alums, metallo- and metalli-cyanides. Moreover, potassium manganate and permanganate find a parallel in potassium osmite, potassium ruthenate, and per-ruthenate.

In many cases, a regular gradation of properties can be traced from manganese to cobalt, and a corresponding gradation from ruthenium to palladium, and from osmium to platinum. C. S.

[Determination of the] Melting Points of the Iron Group Elements by a New Radiation Method. George K. Burgess (*Bureau Stand. Washington*, 1907, **3**, (3), 345—355).—The m. p. of minute quantities of difficulty fusible substances have been determined by a method based on the measurement of the intensity of a particular monochromatic radiation from platinum (compare *Bureau Stand. Washington*, 1905, **1**, 189; 1907, **3**, 1). Within a blackened brass cylinder filled with hydrogen is a strip of platinum, $60 \times 4 \times 0{\cdot}02$ mm., which is heated electrically to any desired temperature. On this strip is placed about 0·001 mg. of a metal or its oxide, which is watched through a mica window in the cylinder by one observer through a microscope, whilst simultaneously a second observer reads the temperature of the platinum strip by means of a Holborn-Kurlbaum optical pyrometer. The indications of the pyrometer are subject to two corrections, one for the reflection and absorption of the mica, the other for the selective emission of the platinum for the light used, red light, $\lambda = 0{\cdot}66\mu$.

The following metals, in a state of maximum obtainable purity, have m. p.: iron, 1505°; chromium, 1489°; cobalt, 1464°; nickel, 1435°; manganese, 1207°. The m. p. of cobalt and nickel are correct to within 5°, those of the other three to within less than 10°. C. S.

Constitution of Roussin's Salts. Livio Cambi (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 658—660. Compare Abstr., 1907, ii, 960).—The simultaneous action on potassium heptanitrosulphide of mercuric cyanide, in amount equivalent to the sulphur present, and potassium cyanide in the quantity necessary for the complete formation of ferrocyanide, yields mercuric sulphide, alkali nitrite, and ferrocyanide, as would be expected from the constitution attributed to Roussin's salts by the author (*loc. cit.*).

The phenomena observed in the precipitation of Roussin's salts by silver nitrate have led the author to assume that hyponitrous acid reduces ferric to ferrous salts. Preliminary experiments indicate that this reduction does not take place. The investigation is being continued. T. H. P.

1 : 2-Dichlorotetramminecobalt Salts; Ammonia-violeo-Salts. ALFRED WERNER (*Ber.*, 1907, 40, 4817—4825).—Numerous examples of stereoisomerism of cobalt salts containing organic amino-residues have been described (Jörgensen, Abstr., 1898, ii, 226; Werner and others, 1901, i, 510, 512; 1907, i, 188, 290, 482, 590). Hitherto, the simplest tetramminecobalt salts, for example, the dichlorotetramminecobalt salts, $[Cl_2Co(NH_3)_4]X$, have been obtained in one form only, the so-called *praseo*-salts; a stereoisomeric series of salts, the *violeo*-salts, has now been prepared by the action of hydrochloric acid on octamminedioldicobalt salts (Abstr., 1907, ii, 965). When concentrated hydrochloric acid is used at low temperatures, the reaction proceeds according to the equation: $[(NH_3)_4\cdot Co(OH)_2Co(NH_3)_4]X_4 + 2HCl = [(NH_3)_4Co(OH)_2]Cl_3 + [Cl_2Co(NH_3)_4]Cl$, a mixture of 1 : 2-diaquotetramminocobalt chloride and 1 : 2-dichlorotetramminecobalt chloride being formed; the former is readily soluble in water, whereas the latter forms sparingly soluble, intensely blue crystals. The violeo-salt contains small amounts of the isomeric praseo-salt, from which it may be freed by conversion into the practically insoluble dithionate. The chloride can then be regenerated by rubbing the thionate with ammonium chloride. The following salts have been analysed: *chloride*, $YCl,\frac{1}{2}H_2O$ $[Y = Cl_2Co(NH_3)_4]$, *bromide*, *iodide*, and *nitrate*, all anhydrous, *dithionate*, $Y_2S_2O_6$, and *sulphate*, Y_2SO_4. The chloride becomes anhydrous at 60°, and all are characterised by an intense, violet-blue colour. The aqueous solutions are somewhat less stable that those of the corresponding praseo-salts; even at 0° the solutions assume a reddish-violet colour owing to the formation of the chloroaquotetramminecobalt salts. When suspended in concentrated hydrochloric acid, the violeo-chloride is converted into the praseo-chloride. The violeo-salt is regarded as a *cis*-compound with the 1 : 2-constitution. J. J. S.

Complex Metal Ammonia Derivatives. VI. Octammine-μ-amino-ol-dicobalt Salts $\left[(NH_3)_4Co\genfrac{}{}{0pt}{}{\cdot NH_2\cdot}{\cdot OH_2\cdot}Co(NH_3)_4\right]X_4$. ALFRED WERNER (*Ber.*, 1907, 40, 4605—4615. Compare Abstr., 1907, i, 1012; ii, 965).—When an ammoniacal cobalt nitrate solution is oxidised by a slow current of air and an excess of sulphuric acid then added, Vortmann's insoluble sulphate separates. The author has shown previously (Abstr., 1898, ii, 223) that this product is not homogeneous, since two compounds, a red and a green, can be separated from it, both of which belong to the class of complex cobalt salts. In the present paper, the constitution of the red salt is elucidated.

Salts of the types in question are decomposed by a mixture of hydrochloric and sulphuric acids into pentammine and tetrammine salts, from which it follows that 4 molecules of ammonia are attached to each of the two cobalt atoms. The constitution of the red series of salts is discussed. The formula : $\left[(NH_3)_4Co{:}NH{\cdot}Co\substack{OH_2\\(NH_3)_4}\right]X_4$ is not favoured, because an imino-group could not be detected; no salt formation took place either with acetic acid or dilute mineral acids; no acetylation took place by the action of acetic anhydride, and no nitroso-compound resulted from the action of nitrous acid. Further, the compounds in question were neutral in aqueous solution and not acid, as would be the case if the formulation just stated were correct. On the other hand, the formulation : $\left[(NH_3)_4Co\substack{\cdot OH\cdot\\ \cdot NH_2\cdot}Co(NH_3)_4\right]X_4$ accords with the experimental results. Since the cobalt atoms are saturated with respect to co-ordination numbers the fact that all the acid groups are inorganic in character is explained. The complex radicle contains no water, and the salts do not, consequently, give an acid reaction when dissolved in water. The amino-group behaves like ammonia in metal ammonia compounds, being indifferent towards chemical reagents in the cold. The hydroxyl group, also, does not have the property of adding on hydrogen ions. For those amino-groups which bind two metal atoms together, the author proposes the nomenclature "μ-amino."

Octammine-μ-sulphatoamino-dicobalt nitrate, obtained from Vortmann's sulphate, was shaken with concentrated hydrochloric acid until the reddish-violet tint of the salt had changed to brown. The product was washed with alcohol, and hydrochloric acid added to its aqueous solution, when the brownish-violet chloro-chloride separates. The following octammine-μ-amino-ol-dicobalt salts were prepared.

The *chloride*, $YCl_4,4H_2O$ $\{Y=\left[(NH_3)_4Co\substack{\cdot NH_2\cdot\\ \cdot OH\cdot}Co(NH_3)_4\right]\}$, forms glistening, brownish-red prisms; by the action of hydrochloric acid, it is converted into pentammine and tetrammine cobalt salts. The *bromide*, $YBr_4,4H_2O$, forms glistening, red scales. The *nitrate*, $Y(NO_3)_4$, forms dark red needles and scales. The *sulphate*, $Y(SO_4)_2,2H_2O$, forms brownish-red, silvery scales. The *dithionate*, $Y(S_2O_6)_2,2H_2O$, forms silvery, raspberry-coloured leaflets. The *thiocyanate*, $Y(CNS)_4$, forms red crystals. A. McK.

Complex Metal Ammonia Compounds. VII. Hexamminetrioldicobalt Salts.

ALFRED WERNER [and, in part, EMIL BINDSCHEDLER and ADOLF GRÜN] (*Ber.*, 1907, 40, 4834—4844. Compare Abstr., 1898, ii, 223; 1899, ii, 658; 1907, i, 482, 1012; ii, 965, and preceding abstract).—*Hexamminetrioldicobalt salts* of the type $\left[(NH_3)_3Co\substack{\cdot OH\cdot\\ \cdot OH\cdot\\ \cdot OH\cdot}Co(NH_3)_3\right]X_3$ may be prepared by the following methods. 1. The chloride is obtained by the action of sodium hydroxide solution on dichloroaquotriammine cobalt chloride. 2. The sulphate by the action of sodium hydroxide solution on chlorodiaquotriammine cobalt sulphate. 3. The bromide by warming chlorobromoaquotriammine cobalt bromide with a little water at 60°. 4. The sulphate by leaving chlorodiaquotriammine cobalt sulphate with potassium bromide solution for several days at the ordinary temperature.

When decomposed with halogen hydracids, the salts give quantitative yields of triamminecobalt salts, indicating that three ammonia residues are attached to each cobalt atom. The acid residues are readily ionised, as each salt can be transformed into the others by double decomposition. Their aqueous solutions are quite neutral to litmus, and hence the salts cannot be aquo-salts. They are isomeric with the black dodecamminehexoltetracobalt salts:

$$\left[\mathrm{Co(OH)_6[Co(NH_3)_4]_3}\right]\mathrm{X_6}.$$

The following salts have been prepared. *Chloride*,

$$\mathrm{[(NH_3)_3Co(OH)_3Co(NH_3)_3]Cl_3,H_2O},$$

best obtained by rubbing the sulphate with ammonium chloride and water, brownish-red needles and prisms from dilute alcohol, decompose at 100°. *Bromide*, anhydrous, red, prismatic crystals, soluble in about thirteen times its weight of water at the ordinary temperature. *Nitrate*, red prisms containing $2H_2O$, becomes anhydrous when kept over sulphuric acid.

Sulphate, crystallises with $6H_2O$, pale red prisms, loses $5H_2O$ over phosphoric oxide and the last molecule at 77°.

Dithionate, $\mathrm{[(NH_3)_3Co(OH)_3Co(NH_3)_3]_2(S_2O_6)_3,H_2O}$, obtained by the action of a saturated solution of sodium dithionate on a solution of the bromide at 0°, dark red needles and prisms. *Thiocyanate*, anhydrous, dark red needles, soluble in 3 parts of water at the ordinary temperature. J. J. S.

Pentamminecobalt Salts with Several Nuclei. Julius Sand and G. Bökman (*Ber.*, 1907, **40**, 4497—4504).—Sand and Genssler have described two, a black and a red, series of pentamminenitrosocobalt salts (Abstr., 1903, ii, 549; 1904, ii, 39). These salts, especially those of the black series, are characterised by their great reactivity. The present paper contains an account of the compounds obtained by the action of iodine on the black pentamminenitrosocobalt chloride and nitrate in alcoholic solution, and of the complex salts derived from these.

When boiled with alcoholic iodine, the black chloride,

$$\mathrm{Co_2(N_2O_2)(NH_3)_{10}Cl_4},$$

yields the *chloride*, $\mathrm{[Co_3ClI_2(NH_3)_{15}(H_2O)_2]Cl_6}$, which, after being boiled with hydrochloric acid, separates from its ice-cold aqueous solution on addition of hydrochloric acid, potassium chloride or alcohol in green crystals; with v_{242}, has the molecular conductivity, $\mu = 731$, and gradually decomposes in aqueous solution at 25°, the conductivity increasing with the time. The action of potassium iodide on the chloride in ice-cold aqueous solution leads to the formation of the green, crystalline *iodide*, $\mathrm{[Co_3ClI_2(NH_3)_{15}(H_2O)_2]I_6}$, whilst the action of nitric acid leads to the formation of the *nitrate*, $\mathrm{[Co_3ClI_2(NH_3)_{15}(H_2O)_2](NO_3)_6}$. The solubility of these three salts decreases from the chloride through the nitrate to the iodide which is only very sparingly soluble.

When treated with cold alcoholic iodine, the black nitrate,

$$\mathrm{Co_2(N_2O_2)(NH_3)_{10}(NO_3)_4},$$

forms a green *substance*, which, when boiled with 20% nitric acid, yields the green complex *salt*, $[Co_3I_2(NO_3)(NH_3)_{15}(H_2O)_2](NO_3)_6$. G. Y.

Equilibrium of the System Nickel–Bismuth. A. PORTEVIN (*Compt. rend.*, 1907, **145**, 1168—1170).—The freezing-point curve of mixtures of nickel and bismuth consists of three branches, the points of intersection are given by the reactions $Ni + Bi \rightleftharpoons NiBi(?)$ at 654°, and $Ni + NiBi(?) \rightleftharpoons NiBi_3$ at 462°. In neither case, however, is the reaction complete. M. A. W.

The Green Chromium Sulphates. ALBERT COLSON (*Ann. Chim. Phys.*, 1907, [viii], **12**, 433—467).—A résumé of work already published (compare Abstr., 1905, ii, 94, 460, 592, 639; 1906, ii, 74, 233; 1907, ii, 177, 267, 356, 474, 780). M. A. W.

New Compound of Uranium, the Tetraiodide. MARCEL GUICHARD (*Compt. rend.*, 1907, **145**, 921—922).—When iodine vapour is passed over uranium at 500° in sealed vacuum tubes (this vol., ii, 31), the *tetraiodide*, UI_4, is formed as a crystalline sublimate, consisting of fine, black needles, m. p. about 500°, D^{15} 5·6. It is reduced when heated in hydrogen, decomposed by chlorine, yielding the chloride and iodine trichloride, readily oxidised by oxygen or air to form the oxide, U_3O_8, and dissolves in water to form a green acid solution giving the characteristic reactions of uranium salts.

M. A. W.

Colloidal Hydroxides of Thorium, Zirconium, and Uranium. BÉLA SZILARD (*J. Chim. Phys.*, 1907, **56**, 488—494).—The author considers that there are two distinct classes of colloids, those containing a little electrolyte, which are very stable, and those quite free from electrolytes, which are also fairly stable.

Colloidal thorium hydroxide, free from electrolytes, has been prepared by decomposing thorium nitrate with excess of dilute ammonia and washing the residue until free from ammonia, which takes three to six days. The product is a fine, milky suspension, in which the particles cannot be separated either by filtration or decantation; it is precipitated by electrolytes and by the carbon dioxide of the air. Colloidal zirconium hydroxide was prepared by the same method, and shows similar properties.

Colloidal thorium hydroxide, containing a little electrolyte, has been obtained by adding precipitated thorium hydroxide to thorium tetrachloride so long as the former is dissolved. This solution is much more stable than that free from electrolytes, is not affected by light or by boiling, and is not precipitated by small quantities of electrolytes or by weak acids (compare Müller, Abstr., 1906, ii, 762).

Colloidal uranyl hydroxide, containing a little electrolyte, has been prepared by the gradual addition of uranyl hydroxide to a dilute solution of uranyl nitrate as long as the former is dissolved; the solution thus obtained is orange-yellow in colour and very stable. The uranyl hydroxide for this purpose was obtained by exposing to light a mixture of uranyl acetate and ether and thoroughly washing the resulting precipitate. G. S.

Spitting of the Acid Vanadates of Univalent Metals. Wilhelm Prandtl and Hans Murschhauser (*Zeitsch. anorg. Chem.*, 1907, **56**, 173—208).—In a previous paper (Abstr., 1905, ii, 170), it was shown that, when certain alkali acid vanadates, xM_2O,yV_2O_5, are allowed to cool from high temperatures, a vigorous evolution of oxygen takes place on solidification, the mass spitting as solidifying silver does. On again heating in air, oxygen is absorbed, and the acid vanadates are regenerated. This phenomenon is due to the reversible change of the acid vanadates, xM_2O,yV_2O_5, to vanadylvanadates, $xM_2O,(y-z)V_2O_5,zV_2O_4$, on solidification.

Only the oxides of the univalent elements of the first group in the periodic table give acid vanadates which spit on solidification. The respective oxides were mixed with vanadium pentoxide in varying proportions, and the composition of the mixtures which gave the highest proportion of oxygen determined; the results varied with the nature of the oxide, and were as follows: $Na_2O,6V_2O_5$; $Ag_2O,6V_2O_5$; $K_2O,5V_2O_5$; $Rb_2O,5V_2O_5$; $Cs_2O,5V_2O_5$; $Li_2O,2V_2O_5$. From mixtures of the same alkali oxide with varying proportions of vanadium pentoxide, the same vanadylvanadate is obtained, the composition of the four most important being as follows: $Na_2O,5V_2O_5,V_2O_4$; $Ag_2O,5V_2O_5,V_2O_4$; $2K_2O,9V_2O_5,V_2O_4$; $4Li_2O,7V_2O_5,V_2O_4$. The composition of these compounds was determined approximately by treating the mixtures containing them with boiling dilute ammonia, which dissolves unaltered V_2O_5.

The amounts of oxygen evolved from solidifying sodium and silver vanadates correspond fairly closely with those calculated from the composition of the vanadylvanadates as determined above, so that the reaction is nearly complete, but in the case of the potassium, rubidium, cæsium, and lithium vanadates the amounts of evolved oxygen are much less than the calculated values, showing that the decomposition on cooling is incomplete.

When mixtures of vanadium pentoxide and two alkali oxides are employed, the amount of oxygen evolved is approximately the mean of that obtained with the separate oxides.

The addition of boron trioxide in moderate amount to the mixtures does not affect the evolution of oxygen, but, when considerable amounts of phosphates are present, the fused mass solidifies without the liberation of oxygen, probably owing to the previous formation of vanadyl phosphate. G. S.

Silicon Chains. Wilhelm Manchot and H. Fischer (*Annalen*, 1907, **357**, 129—139. Compare Manchot and Kieser, Abstr., 1905, ii, 165; 1906, ii, 83; Vigouroux, Abstr., 1906, ii, 30).—I. *Vanadium Aluminium Silicides.*—When heated together, potassium silicofluoride, aluminium, and ammonium metavanadate form three *vanadium aluminium silicides*, depending on the proportions of the mixture. In presence of an excess of vanadium and small amounts of silicon, the chief product is a silicide, crystallising in small, dark octahedra, together with small amounts of a silicide crystallising in large, hexagonal prisms. As the proportion of silicon is increased and that of vanadium diminished, the octahedra disappear and a silicide crystallising in monoclinic leaflets is formed, becoming the chief product when the mixture contains a large excess of silicon. Of these vanadium aluminium silicides, only the hexagonal silicide, $V_8Al_2Si_{13}$, has been isolated. It crystallises in greyish-white, prismatic needles, D 4·3, hardness slightly above 5, and reacts with hydrofluoric acid with development of heat, forming, in absence of air, a reddish-violet solution containing *vanadium difluoride*, VF_2, which on exposure to air in presence of excess of hydrofluoric acid evolves hydrogen and forms the green vanadium trifluoride solution. The hexagonal silicide is stable towards boiling concentrated hydrochloric, nitric, or sulphuric acid, *aqua regia*, or fused potassium chlorate, remains unchanged when heated in a current of oxygen over the bunsen flame, and is not attacked by chlorine at the ordinary temperature, but at a red heat is converted into volatile chlorides, and is dissolved by fused alkalis or alkali carbonates.

II. *Constitution of the Silicides.*—When treated with an excess of hydrogen fluoride, as was described in the case of the chromium salts (Abstr., 1906, ii, 63), the hexagonal vanadium aluminium silicide evolves seventy-four atomic proportions of hydrogen, whereas if the silicon were completely transformed into the fluoride eighty-two atomic proportions, including eight from the conversion of the difluoride into the trifluoride, should be evolved. It is considered that this points to linkings between silicon atoms which are not resolved by hydrofluoric acid. It is found impossible to construct a formula for the hexagonal silicide in which not more than eight of the thirteen silicon atoms are linked to form a chain.

G. Y.

Action of Sodium and Barium Peroxides on Gold. Aurates. Fernand Meyer (*Compt. rend.*, 1907, **145**, 805—807).—When precipitated gold is added to fused sodium peroxide, a vivid reaction takes place and sodium aurate is formed. A similar, but much less complete, reaction occurs with barium peroxide. From the aurate, auric hydroxide is prepared by means of sulphuric acid, adopting the precautions recommended by Fremy (*Ann. Chim. Phys.*, 1851, **31**, [iii], 478). Analyses of the hydroxide, dried in a vacuum in the dark, agree with the formula $Au_2O_3,3H_2O$, ordinarily written $Au(OH)_3$, but from analyses of the aurates the author proposes the formula $Au_2O_2(OH)_2,2H_2O$. Krüss has described the hydroxide Au_2O_3,H_2O, which he writes AuO·OH. The aurates of sodium (bright green needles) and potassium are prepared by treating a solution of the hydrate with the alkali in an atmosphere free from carbon dioxide, and evaporating in a vacuum in the dark. They have formulæ of the type $M_2(AuO_2)_2$. The salts of the alkali earth metals are obtained by treating solutions of their hydroxides with an alkali aurate solution. They form voluminous, light green precipitates which retain much water, are sensitive to light, and have the formula $M(AuO_2)_2$. The degree of hydration of the aurates is difficult to determine, but it tends towards the limit of $6H_2O$ for those of potassium, calcium, strontium, and barium, and $2H_2O$ for that of sodium. The aurates are stable towards heat when dry, but in solution are decomposed by light or heat, giving a violet-black residue of aurous oxide, Au_2O.

Sulphur dioxide and alcohol (slowly) precipitate metallic gold from their solutions, which with dilute sulphuric and nitric acids form auric hydroxide and a sulphate or nitrate. Hydrochloric acid dissolves them, forming gold chloride and an alkali or alkali earth chloride. With organic matter, they form powders which detonate when heated.
E. H.

Gold Chromate. N. A. Orloff (*Chem Zeit.*, 1907, **31**, 1182).—A solution of *auric chromate*, $Au_2(CrO_4)_3$, is obtained by treating a large excess of freshly-precipitated silver chromate with a solution of auric chloride. On evaporation, the solution deposits at first gold, but subsequently the *chromate*, $Au_2(CrO_4)_3CrO_3$, crystallises from the red mother liquor.
W. H. G.

Mineralogical Chemistry.

Optical Activity of Mineral Oils in Connexion with the Question of their Origin. Roman Zaloziecki and H. Klarfeld (*Chem. Zeit.*, 1907, **31**, 1155—1156, 1170—1172. Compare Kraemer and Spilker, Abstr., 1900, i, 73, 333; Walden, Abstr., 1906, ii, 368; Marcusson, Abstr., 1907, i, 466; Neuberg, Abstr., 1907, i, 577).—As a general rule, light-coloured Galician mineral oils are optically inactive, whereas the heavy, dark-coloured oils are optically active. Of the fractions obtained from the latter oils, only those boiling above, roughly, 200°/12—15 mm. are optically active. Since heavy, dark-coloured mineral oils contain a high proportion of asphaltic and resinous substances, the conclusion is drawn that the optical activity of these oils is almost entirely due to the presence of colophonic and terpene-like hydrocarbons. The authors discuss the several theories which have been advanced to explain the origin of mineral oils, and come to the conclusion that mineral oils are derived, not only from fats of higher animals, but also from substances of both animal and vegetable origin which do not readily putrefy, such as waxes, wax-fats, resins, gums, &c.
W. H. G.

Enstatite-Augite in Diabase from Tasmania. Alfred Osann (*Centr. Min.*, 1907, 705—711).—Analysis I, by Dittrich, is of a pale-coloured pyroxene isolated from a medium-grained, fresh rock (anal. II) composed only of pyroxene and zoned plagioclase:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	51·87	0·21	2·02	3·50	8·98	0·18	16·26	15·70	0·16	0·09	1·20	100·17
II.	52·49	0·62	16·44	2·60	5·30	trace	6·18	11·71	2·06	1·09	1·67	100·06*

* Also trace of P_2O_5.

The grains of pyroxene consist of an intergrowth of two optical varieties, differing in birefringence and in optical orientation (the optic axial plane being parallel to the plane of symmetry in one, and perpendicular to it in the other). An attempt to separate these two portions for analysis was not successful. In the low content of calcium and iron, and in the peculiar optical characters, this pyroxene resembles those of the enstatite-augite series of W. Wahl (*Tsch. Min. Mitt.*, 1907, **26**, 1). The comparatively large amount of water is probably present as basic hydrogen. L. J. S.

Physiological Chemistry.

Tension of Carbon Dioxide in Alveolar Air during Exercise. Bertram J. Collingwood and H. L. F. Buswell (*Proc. Physiol. Soc.*, 1907, xxi—xxii; *J. Physiol.*, **36**).—The method adopted for collecting alveolar air was rather different from that used by Haldane and Priestley, but the results, which show much greater variations than those given by the first-quoted authors, are stated to confirm their statement that the hyperpnœa of muscular work is due to a rise of carbon dioxide pressure in the respiratory centre. W. D. H.

Tension of Carbon Dioxide in Alveolar Air during Chloroform Narcosis. Bertram J. Collingwood and H. L. F. Buswell (*Proc. Physiol. Soc.*, 1907, xxiv—xxv; *J. Physiol.*, **36**).—As anæsthesia advances, there is a well-defined rise of carbon dioxide tension in the alveolar air. Increased tension of the gas in the venous blood also occurs, which is due either to the slowing of the blood-stream, or to deficient lung ventilation. The experiments were made on cats.
W. D. H.

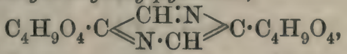
Hypothermolysin. G. Olivi (*Zeitsch. physiol. Chem.*, 1907, **53**, 484—495).—Low temperatures (1° to 2°) alter the red corpuscles, so that their receptors are no longer able to unite with ordinary hæmolysin, but at the same time there is developed a specific anti-substance for the cooled corpuscles which is called *hypothermolysin*. The change produced by cooling is not total, a certain number of receptors remaining unchanged, and capable of uniting with normal hæmolysin. The bearing of this observation on the hæmolysis of paroxysmal hæmoglobinuria and rheumatism is discussed. W. D. H.

The Chemical Hæmolysins. III. Albert J. J. Vandevelde (*Bull. Soc. chim. Belg.*, 1907, **21**, 373—380. Compare Abstr., 1907, ii, 792).—The paper is partly polemical against Fühner (Abstr., 1907, ii, 631), and deals with the hæmolytic action of ethyl alcohol, digitalin, strophantin, saponin, difluoroethyl alcohol, the three isomerides, *iso*propyl formate, methyl propionate, and ethyl acetate, the three compounds, *iso*butyl acetate, ethyl *iso*butyrate, and *iso*propyl propionate, the toluic acids, and the nitro-, hydroxy-, and amino-benzoic acids towards defibrinated ox-blood. The value 15·4888% by weight (Abstr., 1907, ii, 632) for the limiting hæmolytic value of ethyl alcohol is confirmed. The critical coefficient (the ratio of isotoxic quantities of the substance and of ethyl alcohol, multiplied by 100) of digitalin (Merck) and of digitoxin (Merck) in alcoholic solution is 0·0036, in aqueous solution, 0·40. Comparison of these two figures gives further evidence that substances have a greater toxicity in alcoholic solution than when alone. The critical coefficient of strophantin or ouábain, and of saponin, in alcoholic solution is 0·13. Difluoroethyl alcohol has a critical coefficient, 92·92, showing that substitution of fluorine only slightly alters the toxic properties of ethyl alcohol (of which the critical coefficient is obviously 100). Comparison of the critical coefficients of *iso*propyl formate (5·67), methyl propionate (5·67), and ethyl acetate (11·31), and also of *iso*butyl acetate (4·34), ethyl *iso*butyrate (4·85), and *iso*propyl propionate (5·19), shows that the more symmetrical isomeride has the higher value. The values obtained for the critical coefficients of the substituted benzoic acids have already been described (Abstr., 1907, ii, 890). E. H.

Nature of the Alkalinity of Intestinal Juice. EGIDIO POLLACCI (*Boll. Chim. Farm.*, 1907, **46**, 789—791).—The alkalinity of intestinal juice is, at least partially, due to the presence of ammonia or an ammonium compound. The total volatile alkali evolved on heating 1000 grams of the fresh intestines of the hog amounts to 0·0268 gram of ammonia or 0·1513 gram of ammonium carbonate, or 0·531 gram of ammonium oleate. T. H. P.

Animal Digestion. E. S. LONDON and W. W. POLOWZOWA (*Zeitsch. physiol. Chem.*, 1907, **53**, 429—452).—From experiments on dogs with fistulæ, the following conclusions are drawn; about 50% of the digested products are absorbed in the jejunum, and from 40—60% of the nitrogen. The concentration of protein cleavage products in the fluid to be absorbed is about 0·4%. By gastric digestion alone, the protein material passes into the intestine in an absorbable state. Glycine is absorbed in the same measure as the higher products of protein cleavage. The addition of the duodenal juices to the products of gastric digestion does not increase the rate of absorption. About 30% of the duodenal juices is absorbed in the jejunum. Aqueous solutions of monobutyrin and sodium oleate pass through the intestine more slowly than fluids which contain protein cleavage products. Sodium oleate is absorbed more slowly than monobutyrin and protein cleavage products; it causes increased secretion of intestinal juice. Solutions of sugar and dextrin are rapidly and completely absorbed in the jejunum. Dextrin solutions cause little or no secretion of bile, but an abundant secretion of pancreatic juice. All these statements are supported by figures, and details are added on rate of digestion *in vitro* with mixtures of juices. W. D. H.

Behaviour of Glucosamine, and of the First Product of its Transformation, in the Animal Body. KARL STOLTE (*Beitr. chem. Physiol. Path.*, 1907, **11**, 19—34).—Free glucosamine (chitosamine), dissolved in water or in methyl alcohol, is gradually changed, as was shown by Lobry de Bruyn (Abstr., 1899, i, 732), into a substance which can also (and more readily) be obtained by the action of alcoholic ammonia on lævulose. The molecular weight of the acetyl derivative of this substance has now been determined, and shows that Lobry de Bruyn's formula must be doubled, so that it becomes $C_{12}H_{20}O_8N_2$. The acetyl derivative, $C_{28}H_{36}O_{16}N_2$, contains eight acetyl groups, and not four as supposed by Lobry de Bruyn. When oxidised with hydrogen peroxide, the substance is now found to yield pyrazine-2 : 5-dicarboxylic acid, previously described by Stöhr (Abstr., 1892, 507 ; 1893, i, 487). The transformation product of glucosamine and of lævulose, for which the name *fructosazine* is suggested, is therefore 2 : 5-*ditetrahydroxybutylpyrazine*,



$$C_4H_9O_4\cdot C\Big<\begin{matrix}CH{:}N\\ N\cdot CH\end{matrix}\Big>C\cdot C_4H_9O_4,$$

and its formation from glucosamine would appear to take place according to the equation $2C_6H_{13}O_5N + O = C_{12}H_{20}O_8N_2 + 3H_2O$.

By means of intravenous injection into rabbits, the maximum dose of glucosamine was now determined which could be broken down by the organism without any of the substance passing into the urine. This dose was very small, 1/25 of the corresponding quantity of dextrose and of lævulose. A transformation into fructosazine in the organism could not be observed with certainty. Moderate doses of fructosazine, up to one gram, when given *per os*, were completely oxidised. G. B.

Value of Ultimate Protein Cleavage Products in the Organism; Experiments on a Dog with Eck's Fistula. Emil Abderhalden and E. S. London (*Zeitsch. physiol. Chem.*, 1907, **54**, 80—85. Compare Abstr., 1907, ii, 369, 892).—A dog with an Eck's fistula (a connexion between the portal vein and vena cava inferior, cutting out the liver from the portal circulation), not only remained in nitrogenous equilibrium, but retained nitrogen when fed on the ultimate cleavage products of protein (meat) for eight days. This result does not give support to the view that the liver plays an essential part in protein synthesis, but rather that this synthesis takes place in the intestinal wall. G. B.

Comparative Study of Phenols as Agents in Parthenogenesis. Yves Delage and P. de Beauchamp (*Compt. rend.*, 1907, **145**, 735—738).—Loeb's hypothesis that parthenogenesis is due to certain agents increasing the velocity of oxygen-transport is not supported by the present experiments; for substances such as catechol, quinol, and pyrogallol, which have this property in a high degree, are the least active in promoting parthenogenesis, whilst resorcinol and phloroglucinol are very active, although they possess little or no power of transporting oxygen. How these materials act, and how sugar acts as a favouring factor in their action, are subjects which are discussed, but not decided. W. D. H.

Physical and Chemical Properties of Nerves. I. Nathaniel H. Alcock and G. Roche Lynch (*J. Physiol.*, 1907, **36**, 93—103).—The average percentage of water in medullated nerves varies in different species of animal; for instance, cat, 67·3; dog, 75·4, and horse, 69·3. The percentage in the non-medullated nerves of the horse is 81·2. There are also variations in the same species, and in different nerves of the same animal. Cats' nerves remain unchanged in weight in 1·16% sodium chloride solutions; in 1·17% solutions they lose weight, and in 1·46% solutions of potassium chloride, they gain weight. The average percentage of chlorine in medullated and non-medullated nerves of the horse is the same (0·23). The medullary sheath contains less water than the axis cylinder, but a not dissimilar amount of chlorine. W. D. H.

Sulphur Compounds of the Nervous System. Waldemar Koch (*Zeitsch. physiol. Chem.*, 1907, **53**, 496—507).—The sulphur compounds of nervous tissue are divided into four groups: (1) that of lipoids, for example, protagon; (2) that of extractives soluble in 95% alcohol; (3) that of extractives insoluble in boiling alcohol and ether, but soluble in cold water; (4) that of proteins. The view is advanced that in so-called protagon, a sulphur compound acts as a link between lecithin and cerebrin. The sulphur compound under heading (2) consists as to one-tenth of its amount of inorganic sulphates, and the remainder of a taurine-like compound. Those under heading (3) consist mainly of inorganic sulphates, but the presence of protein-like sulphur compounds (gelatin?) is suggested. The protein sulphur (heading 4) is contained in neuro-keratin and nucleo-protein. The amount in albumin and globulin was not estimated. Estimation of these substances in grey and white matter shows that grey matter contains nucleo-protein, globulin, and neutral sulphur, and white matter contains the higher proportion of neuro-keratin and lipoid-sulphur. The importance of the sulphur compounds for the oxidation processes in the brain is discussed; the brain has to be provided with excess of oxygen in order to perform its work. In *Dementia præcox* there is a marked lessening of the neutral sulphur (35% on the average; three cases), and a rise of inorganic sulphates; the lipoid-sulphur is not altered. Interference with oxidation processes will explain some of the symptoms of this disease. W. D. H.

Glycogen in Frogs during Inanition. Eduard Pflüger (*Pflüger's Archiv*, 1907, **120**, 253—289).—The author's previous work has shown that during inanition in dogs, glycogen does not entirely disappear from the body; in one animal, for instance, after a fast of twenty-eight days, the liver and muscles still contained fifty-two grams of glycogen. The present experiments on frogs confirm this. They were kept for months, from August onwards, in water renewed daily, no food was given; flies and other insects being kept out of the trough by a fine net. At intervals, ten frogs were taken and analysed by methods which are described in full. There is no accumulation of glycogen before the winter sets in; artificial warmth, like the summer, causes the glycogen to diminish, and a slight diminution was noticed in the first month. After this, the glycogen steadily increased from 47% to 56%. Indeed, the increase was almost as marked as in frogs freshly collected from time to time, in which case, of course, food was available. W. D. H.

General Mechanism of the Transformation of Glycogen into Dextrose in the Muscles and Tissues. F. MAIGNON (*Compt. rend.*, 1907, **145**, 730—732).—The muscles possess an amylase which is regarded as the agent which transforms glycogen into sugar. This occurs continuously in the normal state, but is exaggerated under certain influences; crushing accelerates it, because by that means the glycogen and the enzyme are brought more closely into contact.

W. D. H.

Creatine and Creatinine in Meat and Meat Extracts. A. D. EMMETT and HARRY S. GRINDLEY (*J. Biol. Chem.*, 1907, **3**, 491—516. Compare Abstr., 1906, ii, 242).—With certain modifications, the Folin method is as applicable to meat and meat extracts as it is to urine. Creatine and creatinine together are present to the extent of 0·45% in meat, and from 1·4% to 6·5% in meat extracts. Hehner gives the latter number as 10—12%; his methods are criticised. W. D. H.

Chemical Composition of Hair. THOMAS A. RUTHERFORD and PHILIP B. HAWK (*J. Biol. Chem.*, 1907, **3**, 459—490).—The chemical composition of human hair is influenced by race, sex, age, colour of hair, and other factors. As judged by the numerous tables presented, the differences do not appear to be great. In different races, the sulphur-nitrogen ratio, for instance, varies from 1 : 3·2 to 1 : 2·9.

W. D. H.

Tissue Respiration in Perfused Kidneys. HORACE M. VERNON (*J. Physiol.*, 1907, **36**, 81—92. Compare Abstr., 1907, ii, 111).—After perfusion of an excised mammalian kidney with Locke's solution for eleven hours, the gaseous metabolism falls to half its initial value. This does not occur if 2% of rabbit's serum is added; sheep's serum is less efficient, egg-white much less so, and milk is of no value at all. Witte's peptone (0·01% to 1%) is as efficient as serum proteins; diglycyl-glycine, glycine, and leucine have a slight sustaining influence, but urea produces a distinct improvement. W. D. H.

Crab Extract. IV. D. ACKERMANN and FRIEDRICH KUTSCHER (*Zeitsch. Nahr. Genussm.*, 1907, **14**, 687—691).—In addition to the bases recorded previously (Abstr., 1907, ii, 283, 491) as being present in this extract, the following have been isolated: crangitine, methylpyridonium hydroxide, neosine, and crangonine.

Crangitine hydrochloride, m. p. 160°. The *aurichloride*,

$$C_{13}H_{20}O_4N_2,2HAuCl_4,$$

forms short, pale yellow prisms, m. p. 162—165°. *Crangonine aurichloride* forms groups of short needles, m. p. 130—140° (not sharp). Neither base was obtained in the uncombined state. W. P. S.

Spectroscopic and Chemical Behaviour of the Pigment Secretion of Aplysia punctata. RAFFAELE PALADINO (*Beitr. chem. Physiol. Path.*, 1907, **11**, 65—70).—A table is given of the absorption spectra of the pigment in various solvents; the results differ not inconsiderably from those obtained by previous observers, such as MacMunn (Abstr., 1899, ii, 313). The chloroform extract of a solution of the pigment in dilute acetic acid left, on evaporation, a partially crystalline substance, containing nitrogen and iron and, perhaps, traces of manganese. G. B.

Excretion of Creatine and Creatinine in Hepatic Disease. E. MELLANBY (*Proc. Physiol. Soc.*, 1907, xxiii; *J. Physiol.*, **36**).—In ascitic fluid due to liver disease, no creatine or creatinine is found. In this condition, creatinine is diminished in the urine; this is attributed to circulatory disturbance and lessened hepatic functions. Creatine in the urine is increased in cancer of the liver (two cases); this is attributed to breakdown of muscle, failure to convert it into creatinine, or a direct production in the tumour. W. D. H.

Metabolism in Alcaptonuria. EMIL ABDERHALDEN and BRUNO BLOCH (*Zeitsch. physiol. Chem.*, 1907, **53**, 464—483).—Administration of large amounts of water to a patient suffering from alcaptonuria caused a great increase in the excretion of nitrogen, but the quantity of homogentisic acid remained constant; the urinary ammonia was increased. The action of water is believed, not to be due to an increase of nitrogenous metabolism, but mainly to a washing out of the products readily. No conclusive answer was obtained to the question whether the urinary nitrogen comes chiefly from exogenous or endogenous metabolism; after inanition, however, the rise in excretion after giving nitrogenous food is very rapid. Some observations were also made on the value of gelatin and amino-acids in the diet. About half of the protein-nitrogen was replaceable by gelatin, but it is of importance not merely to examine the urine on the day of administration, as after effects are seen for some days later. Both gelatin and amino-acids increased the excretion of homogentisic acid.
W. D. H.

Uroleucic Acid. ARCHIBALD E. GARROD and WILLIAM H. HARTLEY (*J. Physiol.*, 1907, **36**, 136—142).—The existence of a second alcapton acid in cases of alcaptonuria has been mooted by several observers, who have named it, after Kirk, uroleucic acid. The present investigation lends no support to this idea; uroleucic acid is a residue consisting of homogentisic acid mixed with impurities.
W. D. H.

Xanthine as a Cause of Fever. ARTHUR R. MANDEL (*Amer. J. Physiol.*, 1907, **20**, 439—443).—In fever there is a distinct relationship between rise of temperature and the appearance of purine bases in the urine. The administration of xanthine or caffeine will effect a rise of body temperature in monkeys. This may be neutralised by the simultaneous administration of sodium salicylate. It is suggested (1) that in aseptic fever the fall in uric acid is due to lessened circulation through the kidneys owing to vaso-constriction; (2) that in surgical fever the purine bases are derived from crushed tissues; (3) that in septic fevers the action of toxins is to lessen the power of such tissues as muscle to oxidise xanthine to uric acid, and (4) that xanthine forms a combination with salicylic acid similar to diuretin (= caffeine + salicylic acid), thereby rendering it innocuous.
W. D. H.

Action of Aconitine on Nerve Fibres. AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1907, xxx—xxxii; *J. Physiol.*, 36).—If a frog is chloroformed and then killed by aconitine, its nerves give no electrical response on excitation. If a normal frog's nerve is bathed in a solution of aconitine, it exhibits a peculiarity also produced by protoveratrine, namely, the response is persistent, and is not followed by an after effect in the opposite direction; the normal unfatiguability of a normal nerve is also abolished. W. D. H.

Physiological Action of Adrenaline. W. KRETSCHMER (*Arch. exp. Path. Pharm.*, 1907, 57, 423—437, 438—440).—The administration of repeated doses of adrenaline in animals raises the blood-pressure until a maximum is reached, and it can be kept up by keeping up the injection. On cessation, the blood-pressure returns to normal, the rate of return being inversely proportional to the amount in the blood previously, and this gradually disappears. The rate of return is decreased by the administration of acids, the acid ions inhibiting the destruction of adrenaline in the blood and tissues.

W. D. H.

Hypnotic Action of the Valeric Acid Group. A. VAN DER EECKHOUT (*Arch. exp. Path. Pharm.*, 1907, 57, 338—357).—The recently-introduced narcotic *Bromoural* is monobromo*iso*valerylcarbamide, $CHMe_2 \cdot CHBr \cdot CO \cdot NH \cdot CO \cdot NH_2$, m. p. 149°. It is a pure narcotic, producing no primary excitation and no ill effects even in large doses in frogs, rabbits, and dogs. It acts rapidly, having a selective action on the cerebrum, and leaving the bulb and cord intact. It has no cumulative action. A large number of similar substances were investigated, and, as a rule, their activity is proportional to their solubility in fats. Chloro*iso*valerylcarbamide and α-bromo-α-methylbutyrylcarbamide are also narcotics; bromo*iso*valeramide is narcotic and toxic; iodo*iso*valerylcarbamide, bromobutyrylcarbamide, and bromobutyramide are toxic, and the following compounds are either very feeble narcotics or are inactive: bromovalerylcarbamide, *iso*valerylcarbamide, valerylcarbamide, bromo*iso*butyrylcarbamide, and bromo*iso*butyramide. W. D. H.

Nitrite Poisoning after the Internal Administration of Bismuth Subnitrate. A. BÖHME (*Arch. exp. Path. Pharm.*, 1907, 57, 441—453).—The administration of large quantities of bismuth subnitrate in men leads to the formation of nitrous acid, and the consequence is methæmoglobinuria. The same follows *in vitro* in bacterial cultures, and is also produced by mixing fœcal matter with the salt. Similar results were obtained in experiments in animals.

W. D. H.

Cresol Poisoning. FERDINAND BLUMENTHAL and ERNST JACOBY (*Biochem. Zeitsch.*, 1907, 7, 39—44).—Whilst it is not denied that cresol affects many organs, such as the liver, injuriously, the principal cause of death is held to be the combination of the poison with the lipoids of the brain. Cresol readily forms compounds with fats and fat-like substances. The amount found per gram of brain is very constant, whatever the dose of cresol given. If, however, the cresol is administered dissolved in olive oil, poisonous symptoms are not readily produced; it is absorbed slowly and excreted by the kidneys rapidly. In such cases, the amount in the brain is much less than when cresol is given in aqueous solution. Full protocols of experiments are given. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Chemistry of the Bacillus Coli Communis. Mary F. Leach (*J. Biol. Chem.*, 1907, **3**, 443—458, Compare Abstr., 1906, ii, 568).—By the action of sodium hydroxide and alcohol, part of the protein of the bacterial cells goes into solution in alcohol, and part remains undissolved. The solution contains the poison of the cell; the insoluble portion includes carbohydrate, nucleic acid compounds, and an immunising substance. Whether the immunising substance contains nucleic acid and depends for its action on this circumstance, is uncertain. W. D. H.

Formation of Glycogen by Yeast. Frederick W. Pavy and Hubert W. Bywaters (*J. Physiol.*, 1907, **36**, 149—163).—Commercial (balloon) yeast contains 5% of glycogen, or 25% in the dry material. Incubation with water decreases the amount slightly, but with dextrose the amount is increased twice or thrice in as many hours. Beyond a certain point, however, increase in the concentration of the dextrose inhibits glycogen formation. Tartaric acid inhibits the process, and favours the disappearance of the glycogen. Sodium phosphate has no influence, but boiled yeast juice promotes glycogen production. The phenomena are due to increased cell growth, and not to simple accumulation of glycogen in pre-existing cells. W. D. H.

Assimilation of Carbon in Bacteria which Oxidise Hydrogen. A. F. Lebedeff (*Biochem. Zeitsch.*, 1907, **7**, 1—10).—Certain bacteria which can assimilate carbon from carbon dioxide liberate free oxygen, and this enables the oxidation of hydrogen to be carried out. The figures given are rather different from those which theory demands, an excess of hydrogen being always observed. The conclusion, however, is drawn that in all probability the chemistry of carbon assimilation in bacteria is not very different from what occurs in green plants. W. D. H.

Fixation of Nitrogen in Soil by Free Bacteria, and its Importance for the Nutrition of Plants. Alfred Koch, J. Litzendorff, F. Krull, and A. Alves (*J. Landw.*, 1907, **55**, 355—416).—Assimilation of nitrogen in soils is increased by addition of dextrose, sucrose, soluble starch, and probably cereal straw, the amount thus fixed being 8—10 mg. per gram of sugar. Frequent applications of sugar tend to diminish rather than increase the amount of nitrogen fixed. The best results in relation to the amount of sugar were obtained with one application of 2%.

Fixation of nitrogen was increased by superphosphate, basic slag, and iron sulphate, and retarded by lime, potassium sulphate and chloride, carbon disulphide, and, perhaps, by magnesium sulphate.

N. H. J. M.

Biological Succession of Mineral Substances in Marine Algæ. Francesco Scurti and S. Caldieri (*Chem. Zentr.*, 1907, ii, 1089; from *Staz. sperim. agrar. ital.*, 1907, **40**, 225—233).—In continuation of the work of Scurti (Abstr., 1907, ii, 122), it has been found that the elements contained in the marine algæ can be arranged in two groups. Those of the first group, including chlorine, calcium, magnesium, potassium, sodium, and silicon, gradually increase in quantity during the formation of the spores, whilst, after their appearance, these elements gradually decrease. The second group embraces iodine and phosphorus. The behaviour of iodine has already been recorded (*loc. cit.*). Phosphorus is absorbed during the production of the spores, but, unlike the elements of the first group, it still further increases in amount after maturation is at an end, and thus reaches its maximum in winter.

E. G.

Application of Bio-chemical Methods for the Detection of Sugars and Glucosides in Plants of the Tribe Taxeæ. Charles Lefebvre (*Arch. Pharm.*, 1907, **245**, 493—502. Compare Abstr., 1907, i, 864).—Indication of the presence of various sugars and glucosides in extracts of plants, &c., may be obtained by treating these extracts with enzymes, such as invertase and emulsin. The change in the optical rotatory power of an extract of young twigs of *Taxus baccata* on treatment with invertase appeared to point to the presence of sucrose, but practically the same change is observed on treating raffinose with invertase. However, by treatment with barium or strontium hydroxide and fractional precipitation with alcohol were obtained, besides raffinose (compare Abstr., 1907, ii, 715), crystals of sucrose and indications of the presence of a lævorotatory sugar which does not reduce Fehling's solution. Investigation of twigs of *Taxus baccata* gathered at various times of the year showed that the quantity of sugars present does not vary considerably, whilst the quantity of taxicatin present is greatest in the autumn and winter and smallest from April to July.

The leaves and twigs of *Cephalotaxus drupacea*, *Cephalotaxus pedunculata*, *Podocarpus Chinensis*, and *Torreya myristica* all contain sugars, glucosidic substances hydrolysed by emulsin, and ferments similar in action to invertase and emulsin.

W. H. G.

Causes of the Displacement of Absorption Bands in the Leaf. D. Iwanowski (*Ber. deut. bot. Ges.*, 1907, **25**, 416—424).—In the investigation of the well-known difference between the spectrum of a living leaf and that of an alcoholic chlorophyll solution, the spectro-photometric method is preferable to the spectroscopic. By means of the former method, the leaf-spectrum is found to differ from that of the solution in having a much greater absorption at the red end (a—B), and in having both the principal absorption bands somewhat displaced towards the red. This difference has generally been attributed to the chlorophyll of the chloroplasts being in the solid state. Solid solutions of chlorophyll in gelatin and in paraffin-wax were, however, found to have a spectrum differing but slightly from that of an alcoholic solution.

By adding a little neutral salt (for example, $MgSO_4$) to a concentrated alcoholic chlorophyll solution greatly diluted with water, the author obtained a fine suspension, which had a spectrum very similar to that of the living leaf. This similarity is attributed to the circumstance that in both cases the spectrum is largely due to the reflected light, whereas in the case of an alcoholic chlorophyll solution it is wholly formed by transmitted light. G. B.

Fruit of Celestrus scandens and Solanum Dulcamara. A. A. Wells and Grant S. Reeder (*Chem. News*, 1907, **96**, 199—200).—Berries of *Celestrus scandens* were found to contain lævulose, tartaric acid, and gallic acid. The seeds contain palmitic acid, and an oil which yields olein and a small amount of palmitin when hydrolysed. Berries of *Solanum Dulcamara* contain tartaric and citric acids and fructose. N. H. J. M.

Supposed Toxicity of Hungarian Haricots. Léon Guignard (*Compt. rend.*, 1907, **145**, 1112—1118).—A reply to Evesque, Verdier and Bretin (Abstr., 1907, ii, 912). The author has examined a sample of the Hungarian haricots stated by Evesque, Verdier and Bretin to contain 0·342 gram of hydrogen cyanide per kilo., and finds that, in common with all the specimens of Hungarian haricots that he has examined (Abstr., 1906, ii, 301), they do not contain a trace of hydrogen cyanide. He also shows that the method of macerating the beans with water containing tartaric acid, preliminary to estimating the hydrogen cyanide, is untrustworthy, as the tartaric acid exercises a paralysing effect on the ferment (emulsin) that causes the hydrolysis of the cyanogenetic glucoside. M. A. W.

Chemistry of Mistletoe (Viscum album). M. Leprince (*Compt. rend.*, 1907, **145**, 940—941).—The author has obtained 1·6 grams of a crystalline hydrochloride of a base from 25 kilos. of dry mistletoe plant; the crystalline *platinichloride*, $(C_8H_{11}N)_2,H_2PtCl_6$, decomposes at 250°. M. A. W.

Inosites of Mistletoe. Georges Tanret (*Compt. rend.*, 1907, **145**, 1196—1198).—The fresh ripe berries of mistletoe contain in addition to dextrose, lævulose, and sucrose, *i*-inosite and *r*-inosite; 12 grams of the former and 4 grams of the latter being obtained from 1 kilo. of the fresh fruit, or four times these quantities from 1 kilo. of dry fruit. Up to the present, the leaves of the walnut tree have formed the chief source of *i*-inosite (Tanret and Villiers, Abstr., 1877, ii, 304; 1878, 390; Maquenne and Tanret, Abstr., 1890, 471), but the yield is only one-sixteenth of that afforded by mistletoe. The isolation of *r*-inosite from mistletoe is important as affording the first instance of the separation of a racemic sugar from a living organism. The leaves of the mistletoe plant also contain the inosites, probably in the form of some compound, because the author could only isolate 0·50 gram from 1 kilo. of dry leaves. M. A. W.

Lippia scaberrima (Beukess Boss). FREDERICK B. POWER and FRANK TUTIN (*Arch. Pharm.*, 1907, **245**, 337—350; *Amer. J. Pharm.*, 1907, **79**, 449—462).—Dried stems and leaves of this South African plant were examined. In addition to resins and other amorphous products, the following substances were isolated. (1) An aromatic essential oil (0·25%), b. p. 220—230°, D^{15}_{15} 0·950, $\alpha_D + 7°36'$ (100 mm. tube). (2) Heptacosane, $C_{27}H_{56}$, m. p. 59°. (3) Hentriacontane, $C_{31}H_{64}$, m. p. 68°. (4) A paraffin, m. p. 80°, in very small amount. (5) A phytosterol, $C_{27}H_{46}O$, m. p. 134°. (6) Unsaturated alcohols, probably of the general formula, $C_nH_{2n-4}O$, and containing one double linking. (7) Formic and butyric acids in the uncombined state. (8) Esters of various acids, including formic, butyric, valeric, arachic, and linoleic. (9) *Lippianol*, $C_{25}H_{36}O_4$, a colourless, crystalline substance, having the properties of a monohydric alcohol; m. p. 300—308° (decomp.), $[\alpha]_D$ +65° in 0·5% alcoholic solution. (10) Minute quantities of two yellow, crystalline *substances*, m. p. 267° (approx.), and a trace of a colourless, crystalline *substance*, m. p. 123°. (11) Dextrose (mainly in the inactive form). A glucoside-like substance was also present, but was not isolated; it yielded on hydrolysis dextrose and other products which were not identified.

C. F. B.

The Fruit of Styrax Obassia. Y. ASAHINA (*Arch. Pharm.*, 1907, **245**, 325—328).—By extracting the husks with 60% alcohol, *styracitol* was obtained in yield equal to 10% of the drug. This crystalline substance, $C_6H_{12}O_5$, m. p. 155°, $[\alpha]^{20}_D$ −71·72°, is very readily soluble in water, sparingly so in strong alcohol; reduces ammoniacal silver nitrate, but not Fehling's solution, even after boiling with dilute mineral acids, although it does so after oxidation with sodium hypobromite or nitric acid; does not form a compound with phenylhydrazine acetate or with benzaldehyde when shaken with the latter and 50% sulphuric acid; yields no crystalline acetyl or benzoyl derivative; forms β-hexyl iodide when distilled with hydriodic acid and yellow phosphorus.

The kernels yielded 18% of fatty *oil* when extracted with ether. The oil expressed from the seeds had D^{15} 0·974°, acid number 9, saponification number 180, iodine number (Hübl) 127, Hehner's number 91. C. F. B.

Physico-chemical Processes in the Production of Soil. PAUL ROHLAND (*Chem. Zentr.*, 1907, ii, 724; from *Landw. Jahrb.*, **36**, 473—483).—The colloids present in soils are derived from feldspar by the action of water and carbon dioxide. Their coagulation by electrolytes probably depends on the simultaneous separation of hydroxyl ions from the alkali. Soils containing colloidal hydroxides at a constant temperature take up or lose water until the vapour tension of the colloid equals the surrounding vapour tension. Alterations in temperature continuously alter the amount of water.

Adsorption is attributed partly to chemical actions, partly to adsorption, and is perhaps also due to catalytic influences. N. H. J. M.

Protective Action of Colloids on Clay Suspensions. GUSTAV KEPPELER and ALBERT SPANGENBERG (*J. Landw.*, 1907, 55, 299—300).—Fickenberg (*ibid.*, 1906, 343) showed that much greater amounts of alkali are required to flocculate suspensions of natural clay soil than in the case of kaolin, and attributes his results to a protective action exercised by the humus.

Determinations of the amounts of alkali required for flocculation showed that varying results are obtained with different soils, and it is found that the amounts depend on the quantity of humic acid in the soil. N. H. J. M.

Movement of Ammoniacal Nitrogen in Nature. PAUL EHRENBERG (*Chem. Zentr.*, 1907, ii, 723—724; from *Mitt. Landw. Inst. K. Univ. Breslau*, 1907, 4, 1—254).—Loss of ammonia by evaporation from soils is only to be expected in the case of sandy soils containing much calcium carbonate and deficient in zeolitic compounds and humus, and then only at the highest summer temperatures, when the soil is dried up, and when there has been a heavy application of nitrogenous manure. Even then the loss is extremely small.

Ammonium salts are undoubtedly directly utilised by plants. With the exception, however, of plants utilising acids, the amount of nitrogen so taken up is insufficient, and for satisfactory growth nitrification is essential. N. H. J. M.

Influence of Plant Constituents on the Physical and Chemical Properties of Soils. VIKTOR ZAILER and LEOPOLD WILK (*Chem. Zentr.*, 1907, ii, 732—734; from *Zeitsch. Moorkultur u. Torfverwert.*, 1907, 1—109).—The physical properties of peat, especially when only slightly decomposed, which vary distinctly when the peat is derived from only very distantly related plants, are coherence, density, capacity for holding water, hygroscopicity, and absorptive power; other physical properties seem to depend less on botanical composition. Hygroscopicity decreases as decomposition proceeds, notwithstanding the increase of humus substances. Absorption of ammonia depends chiefly on free humic acid and related colloids.

The amount of ash in peat is generally higher than would be indicated by the botanical composition. Potassium and sodium salts are almost completely washed out, and phosphoric acid to a considerable extent, whilst calcium and iron remain almost unchanged in quantity. The amount of nitrogen depends mainly on the amount originally present in the plants, and to a less extent on chemical processes and chitinous remains. N. H. J. M.

Fallow. WILHELM KRÜGER and BERTHOLD HEINZE (*Chem. Zentr.*, 1907, ii, 726; from *Landw. Jahrb.*, **36**, 383—423).—During a fallow the amount of soluble forms of nitrogen, especially nitrates, increases. The number of micro-organisms increases at first, and then gradually diminishes. The total nitrogen seemed to increase, but this requires confirmation. N. H. J. M.

Manurial Experiments with Different Kinds of Nitrates. JOHN SEBELIEN (*Landw. Versuchs-Stat.*, 1907, **55**, 293—297).—Pot experiments with white mustard, grown in poor sandy soil, showed that the yield when manured with calcium nitrate and with "sulphate-nitrate" respectively was about five times as great as with sodium nitrate, and that far greater amounts of these manures may be applied without injury as compared with the ordinary inorganic nitrogenous manures.

"Sulphate-nitrate" $[CaSO_4 + 2(NH_4)_2NO_3]$ is prepared by mixing calcium nitrate with ammonium sulphate (equal mols.), the idea being to avoid the difficulty in the use of calcium nitrate due to its deliquescence.

Further experiments with oats grown in sandy soil and in loam showed that sodium and calcium nitrates had about equal effects.

N. H. J. M.

Is a Favourable Stimulating Effect on the Development of Crops by Small Amounts of Manganese Salts Observable in the Field? HJALMAR VON FEILITZEN (*J. Landw.*, 1907, **55**, 289—292).—The soil on which the experiment was made consisted chiefly of slightly decomposed sphagnum peat, and has been under cultivation since 1894, when sand and lime were applied, as well as artificial manures which have been applied each year since.

An application of 10 kilos. of magnesium sulphate per hectare was found to have no effect on oats. N. H. J. M.

Leucite and its Application as a Manure. UGO ALVISI and DOMENICO VENDITORI (*Gazzetta*, 1907, **37**, ii, 379—383).—No action takes place between leucitic materials and superphosphates when these are applied together as manures, so that the value of the superphosphate remains uninjured. T. H. P.

Analytical Chemistry.

Improvements in Hemple's Gas-Analysis Apparatus. GEORGE DE VOLDERE (*Chem. Zentr.*, 1907, ii, 1113—1114; from *Zeitsch. chem. Apparatenkunde*, 1907, **2**, 344—346).—The levelling tube is replaced by a levelling reservoir fitted with a side tube having the same diameter as the burette. The burette is constructed as recommended by Pfeiffer

(Abstr., 1907, ii, 194), but the capillary tube between the first enlargement and the stopcock has been omitted, and a four-way cock has been put instead, whilst a second tube serves for the purpose of applying suction or pressure. The chief advantage of this arrangement is that the burette can be fixed firmly by means of a clamp. The U-tube in the pipette has been also replaced by a four-way stopcock. For further details, the illustrations in the original article should be consulted.

A convenient apparatus is also described for the combustion of gases by means of palladium asbestos. L. DE K.

Use of Chloral Hydrate, Chloral Alcoholate, and Bromal Hydrate Solutions in Chemical, Microscopic, and Microchemical Investigations. EDUARD SCHAER (*Ber. deut. pharm. Ges.*, 1907, 17, 407—413).—Aqueous and alcoholic solutions of chloral hydrate and bromal hydrate dissolve a large number of inorganic and organic substances which have no other common solvent. Where complete solution of a mixture is necessary or advantageous as a preliminary step to the detection or separation of its components, the employment of 60% to 80% aqueous or alcoholic chloral hydrate solutions as the solvent is recommended. The value of chloral hydrate as a clearing agent for microscopic preparations depends on its penetrating power, as also on its action as a solvent for the cell contents which render the preparation opaque. In many cases, the best results are obtained by successive treatment with concentrated aqueous and alcoholic solutions. In microchemical analysis, it has been found possible with the aid of chloral hydrate solutions of the alkaloid reagents to determine the location of alkaloids in plant structures. G. Y.

Isolation of Traces of Mineral Substances from Saline Mixtures. Application to Medical Chemistry, Toxicology, and Hydrology. G. MEILLÈRE (*J. Pharm. Chim.*, 1907, [vi], 26, 443—450).—A summary of the methods used in analysis for concentrating small quantities of substances which might otherwise escape detection. For instance, traces of lead in water are carried down completely by adding a little copper sulphate before passing hydrogen sulphide, and phosphoric and arsenic acids are precipitated completely in presence of ferric hydroxide. In some cases, extraction by means of an immiscible solvent in a suitable apperatus gives good results. Strong hydrochloric acid extracts lithia from alkali chlorides, &c. L. DE K.

Addition of Indigo in Titrations with Methyl- or Ethyl-orange. ROBERT LUTHER (*Chem. Zeit.*, 1907, 31, 1172. Compare Kirschnick, Abstr., 1907, ii, 910).—Solutions of indigo-carmin and methyl-orange are mixed in such proportions that, when added to a saturated solution of carbon dioxide in water, a neutral grey tint is obtained (compare Küster, Abstr., 1897, ii, 74). When such a mixture of methyl-orange and indigo-carmin is used, the change of colour during the titration of an alkali with acid is as follows: yellow, green, colourless (or grey if a large quantity of indicator is taken), violet. The change from green or violet to the neutral grey or colourless stage is said to be very decided and sharp. The addition of indigo to solutions which are tinted yellow is also advantageous. W. H. G.

Behaviour of Chlorates and Perchlorates during Reduction. Domenico Venditori (*Gazzetta*, 1907, **37**, ii, 383—386).—In presence of sulphuric acid, finely-divided aluminium reduces chloric acid completely to hydrochloric acid, but has no reducing action on perchloric acid. Chloric acid may hence be estimated by converting it into hydrochloric acid and then estimating the latter by Volhard's method. T. H. P.

Detection of Fluorine Compounds in Wines. L. Vandam (*Ann. Chim. anal.*, 1907, **12**, 466—468; *Rev. intern. Falsif.*, 1907, **20**, 147—148).—Two hundred c.c. of the sample are mixed with a few drops of a 20% solution of sodium sulphate and then with 10 c.c. of a 10% solution of barium acetate. After twelve hours, the bulk of the liquid is poured off, and the precipitate collected on a filter, washed, dried, and ignited in a platinum crucible. After moistening with a drop of water, a little sulphuric acid is added and the crucible is at once fitted with an india-rubber ring supporting a paraffin-coated watch-glass, the convex part of which carries an inscription made with a soft point. The watch-glass is kept cold by a current of cold water. After heating the crucible for half an hour on a boiling water-bath, the watch-glass is gently heated to melt the paraffin coating and wiped with a soft linen cloth. If the sample is pure, no inscription will be visible, or at most but very faintly on breathing on the glass, but a visible etching is noticed even when there is as little as 10 mgs. of ammonium fluoride per litre. L. de K.

Estimation of Sulphur Dioxide in Wines. Carlo Mensio (*Gazzetta*, 1907, **37**, ii, 344—355).—The maximum amount of total sulphur dioxide per litre of wine permitted in Italy is 0·2 gram, of which not more than 0·02 gram should be in the free state. According to the official method of estimation, sulphur dioxide, which is evolved from wine on boiling, is regarded as existing in the free state in the wine. The author shows that this view is inaccurate, since compounds such as that formed by sodium hydrogen sulphite with acetaldehyde give up from 30% to 75% of their sulphur dioxide when boiled in aqueous solution and from 90% to 95% when boiled with wine.

The most accurate method of estimating the total sulphur dioxide in wine consists in acidifying with phosphoric acid and distilling in a current of carbon dioxide, the distillate being collected in iodine solution, in which the sulphur dioxide may be estimated either by titration of the excess of iodine with sodium thiosulphate or by Haas's method (Abstr., 1882, 773). None of the methods given for estimating free sulphurous acid in a wine yields accurate results.

As the experiments of Franz and Rost (Abstr., 1904, ii, 632) indicate that the toxic action of combined sulphur dioxide is not greatly dissimilar from that of the uncombined, and as the presence of the latter in a wine is detectable by the taste, the fixing of a limit to the proportion of free sulphur dioxide should be abolished.

T. H. P.

Digestion of Urine in the Estimation of Nitrogen by the Kjeldahl Method. PHILIP B. HAWK (*J. Amer. Chem. Soc.*, 1907, **29**, 1634—1637).—The nitrogen in urine may be estimated equally well by digestion with sulphuric acid and copper sulphate, sulphuric acid and metallic mercury, or sulphuric acid, metallic mercury and potassium sulphate added towards the end. In any case, the boiling should be continued for at least thirty minutes. L. DE K.

Alkalimetric Estimation of Phosphoric Acid by Neumann's Method. J. P. GREGERSEN (*Zeitsch. physiol. Chem.*, 1907, **53**, 453—463. Compare Abstr., 1903, ii, 243; 1905, ii, 68).—As the result of numerous series of experiments, the conclusion is drawn that Neumann's method gives excellent results when the following precautions are taken. In the destruction of the organic material and the formation of ash, 20 c.c. of Neumann's acid mixture should be used, and during the process concentrated nitric acid, and not the mixed acids, should be dropped in. In the precipitation, 250 c.c. of liquid should be used, and this should contain 15% of ammonium nitrate, only a slight excess of ammonium molybdate being employed; thus, for 10—15 mgs. phosphorus, 4 grams of molybdate suffice. In the final titration, it is advisable to add a slight excess of standard acid, to boil, in order to remove carbon dioxide, and then to titrate back with $0\cdot5N$ sodium hydroxide. J. J. S.

Estimation of Phosphoric Acid in Basic Slags by Grete's Method. C. H. KETNER (*Chem. Weekblad.*, 1907, **4**, 757—764).—Grete's method (titration with gelatin-molybdenum solution until no further precipitate is formed) has been applied successfully in the Dutch agricultural stations, but for soluble phosphoric acid only. The author has tried to use it for total phosphoric acid also, and after some trials has succeeded by working as follows.

Ten grams of the basic slag are powdered, moistened with a little water, and then heated in a 500 c.c. Jena flask with 50 c.c. of sulphuric acid for about half an hour and until white fumes are formed. When cold, water is added, and, when again cooled, water is added up to the mark, and the whole is thoroughly shaken and filtered. Twenty-five c.c. of the filtrate are neutralised with ammonia, 20 c.c. of ammonium nitrate solution (1 : 2), a teaspoonful of powdered potassium nitrate, and 15 c.c. of nitric acid, D 1·2, are added, and the solution is then heated to boiling and titrated. In standardising the gelatin-molybdenum solution as usual with dihydrogen potassium phosphate in presence of the above substances, there should also be added 16 c.c. of 10% ammonia previously neutralised with dilute sulphuric acid.

L. DE K.

Estimation of Arsenic by the Gutzeit Method. CHARLES R. SANGER and OTIS F. BLACK (*J. Soc. Chem. Ind.*, 1907, **26**, 1115—1123).—The modification suggested by the authors in order to make the Gutzeit method quantitative, consists in allowing the arsine to pass over the surface of a strip of paper impregnated with mercuric chloride. The band of colour thus obtained is compared with a series of bands prepared from known amounts of arsenic. The sensitised paper is inserted in the form of a strip in a horizontal delivery tube leading from the evolution flask. The exact method of carrying out the estimation is given at length in the original paper, together with remarks on the precautions to be observed, and on the influence of certain interfering substances. W. P. S.

Estimation of Arsenic in Urine. Charles R. Sanger and Otis F. Black (*J. Soc. Chem. Ind.*, 1907, **26**, 1123—1127; *Zeitsch. anorg. Chem.*, 1907, **56**, 153—157).—The evaporated urine is distilled with hydrochloric acid, the distillate is oxidised with nitric acid, the latter is removed by heating with sulphuric acid, and the remaining solution is used for the estimation of the arsenic. About 200 c.c. of the urine are evaporated to a volume of 35 c.c. and then introduced into a distillation flask. One hundred c.c. of pure hydrochloric acid are added, and the mixture is distilled, the distillate being collected in a receiver containing 25 c.c. of concentrated nitric acid. When about 100 c.c. have distilled over, the distillate is treated with a further 25 c.c. of nitric acid and evaporated to a small bulk; 5 c.c. of sulphuric acid are next added, and the heating continued until the nitric acid has been expelled. The residue is diluted with water to a definite volume, and a part of it employed for the estimation of the arsenic, the Marsh-Berzelius method being used for the latter purpose. W. P. S.

Estimation of Hydrofluosilicic Acid. Samuel Hönig (*Chem. Zeit.*, 1907, **31**, 1207—1208).—The process is based on the fact that 1 mol. of hydrofluosilicic acid is neutralised by 2 mols. of sodium hydroxide when using methyl-orange as indicator, whereas 6 mols. are required if phenolphthalein is the indicator.

Twenty-five c.c. of the sample are titrated with *N*-sodium hydroxide in presence of methyl-orange. The result equals hydrofluosilicic acid and any other mineral acid present. The liquid is now heated to boiling, and titrated while hot with phenolphthalein as indicator. Four mols. of sodium hydroxide now represent 1 mol. of hydrofluosilicic acid. The method is not strictly accurate, owing to the slight dissociation of the sodium silicofluoride formed, but this does not interfere with its technical application. L. de K.

The Carrasco-Plancher Method of Estimating Carbon and Hydrogen in Organic Substances. Wilhelm Lenz (*Zeitsch. anal. Chem.*, 1907, **46**, 557—565).—The results of a number of estimations of carbon and hydrogen in salicylic acid by this method (Abstr., 1906, ii, 201) are given. Whilst in some cases the quantities of carbon and hydrogen found agreed with those required by theory, in others the carbon was as much as 3·5% too low. The loss was due to the formation of carbon monoxide; the quantity of the latter produced appeared to depend on the speed at which the combustion was carried out, the longer the time taken for the estimation the greater the amount of carbon monoxide formed. W. P. S.

Estimation of Carbon Monoxide in Atmospheric Air. J. Livingston R. Morgan and John E. McWhorter (*J. Amer. Chem. Soc.*, 1907, **29**, 1589—1592).—The air is passed first through tubes containing sulphuric acid and potassium hydroxide. If it is desired to estimate also the carbon dioxide, another tube containing standard barium hydroxide is placed in front of the sulphuric acid tube. The carbon monoxide is then absorbed in a U-tube containing iodine pentoxide and heated at 150° in a glycerol-bath. The products of the reaction, free iodine and carbon dioxide, are passed through a tube containing potassium iodide solution, and the iodine is afterwards titrated with $N/1000$ thiosulphate by way of a check. The carbon dioxide is absorbed in standard barium hydroxide, the excess of which is then titrated as usual with standard oxalic acid.

In estimating carbon monoxide by passing it over iodine pentoxide, the ends of the U-tube should be sealed off after filling, so as to avoid traces of greasy matter from the lubricant used with glass stoppers.

L. de K.

Volumetric Estimation of Potassium as the Cobaltinitrite. W. A. Drushel (*Amer. J. Sci.*, 1907, [iv], 433—438; *Zeitsch. anorg. Chem.*, 1907, **56**, 223—329).—A modification of the method proposed by Adie and Wood (Trans., 1900, **77**, 1076). The solution is mixed with excess of sodium cobaltinitrite and a little acetic acid, and evaporated to a pasty condition on a water-bath. The residue is treated with cold water, and the precipitate collected and washed on an asbestos filter. The filter and contents are then heated with excess of $N/10$ permanganate for some five minutes, when excess of dilute sulphuric acid (1 : 7) is added, and the whole heated short of boiling until the manganese precipitate has completely dissolved. The excess of permanganate is estimated as usual by first bleaching with $N/10$ oxalic acid and then titrating with permanganate. Working in this manner, 1 c.c. of $N/10$ permanganate $= 0 \cdot 000856$ gram of K_2O.

The process is suitable for the estimation of potash in manures, not being interfered with by the presence of phosphoric acid. L. de K.

New Volumetric Method of Estimating Sodium Sulphide. E. Podreschetnikoff (*Zeitsch. Farb. Ind.*, 1907, **6**, 388).—The new method permits of the estimation of both sodium hydroxide and sodium sulphide, owing to the latter undergoing complete hydrolysis in dilute solution according to the equation: $Na_2S + H_2O = NaHS + NaOH$. On titrating a very dilute solution of the sulphide with $N/10$ sulphuric acid in the presence of phenolphthalein as indicator, the quantity of sodium sulphide *plus* the free hydroxide is obtained. The amount of sulphide alone is then determined by adding a slight excess of formaldehyde, and titrating by means of the acid, the sodium hydroxide liberated according to the equation: $NaHS + CH_2O + H_2O = NaOH + OH \cdot CH_2 \cdot SH$. The results obtained by this method are quite accurate. W. A. D.

Biological Method for Estimating Alkali Carbonates in Soils. Harald R. Christensen (*Centr. Bakt. Par.*, 1907, ii, 19, 735—736).—It was shown previously that azotobacter is unable to utilise calcium in the form of sulphate, chloride, and tribasic phosphate. It is now shown that some soils, deficient in calcium, in conjunction with mannitol and potassium phosphate, will develop a growth of azotobacter when supplied with calcium sulphate similar to that obtained when calcium carbonate is added. Such soils show almost invariably an alkaline reaction, and the conclusion is drawn that an alkali carbonate is present which interacts with the calcium salt to form calcium carbonate.

It is proposed to utilise the different behaviour of calcium sulphate in different soils for ascertaining the amounts of alkali carbonates present. N. H. J. M.

Volumetric Estimation of Magnesium. Leopold Rosenthaler (*Zeitsch. anal. Chem.*, 1907, 46, 714—716).—The magnesium salt is dissolved and treated with a measured volume (an excess) of potassium hydrogen arsenate, KH_2AsO_4, solution (containing about 9 grams per litre). The mixture is then diluted to a known volume with 10% ammonia and mixed. After three hours, the solution is poured through a filter, and a portion of the filtrate, say 100 c.c., is evaporated to dryness on the water-bath. The residue is dissolved in a very little water, the solution is transferred to a stoppered flask, the basin is rinsed out with a little concentrated hydrochloric acid, which is also added to the flask, and the acid solution is then treated with concentrated potassium iodide solution. If a precipitate forms, a little more water is added; if not, hydrochloric acid is added before adding the water. The liberated iodine is then titrated back with thiosulphate solution. The difference between the amount of potassium hydrogen arsenate added and that found in excess represents the quantity precipitated with the magnesium; 1 c.c. of $N/10$ thiosulphate solution corresponds with 0·002018 gram of magnesia (MgO). W. P. S.

Detection of Small Quantities of Zinc by Electrochemical Means. Walter Neumann (*Zeitsch. Elektrochem.*, 1907, 13, 751—752).—The solution to be tested, containing sufficient potassium hydroxide to render it, roughly, $N/10$, is electrolysed, using a small platinum bead as anode, and a brightly polished, thin copper wire as cathode. Should zinc be present, the copper becomes coated with a bright white deposit of zinc, which may be removed by dipping the wire in $2N$ potassium hydroxide solution. It is possible by this method to detect zinc in 0·1 c.c. of a N/40,000 solution of the metal. The solution to be tested must not contain chloride or nitrate. W. H. G.

A Method of Estimating very Small Quantities of Zinc. Gabriel Bertrand and Maurice Javillier (*Compt. rend.*, 1907, 146, 924—926).—The method described previously (Abstr., 1907, ii, 53) of precipitating small quantities of zinc in the form of hydrated calcium zinc oxide can be employed for the estimation of the metal in solutions containing 0·1 mg. of zinc in 3 litres in the presence of tin, antimony, arsenic, copper, cadmium, cobalt, lead, silver, iron, manganese, aluminium, barium, calcium, magnesium, sodium, and potassium as carbonates, chlorides, sulphates, nitrates, phosphates, silicates and sulphides. For details of the separation, the original must be consulted.

The final separation of the zinc from the calcium in the hydrated calcium zinc oxide is best effected by dissolving in hydrochloric acid, evaporating to dryness, precipitating the zinc as sulphide in the presence of sodium acetate, and weighing as the sulphate. M. A. W.

Rapid Estimation of Zinc by Electrolysis. Francis C. Frary (*J. Amer. Chem. Soc.*, 1907, **29**, 1596—1603).—A solution containing about 8 grams of sodium hydroxide and 0·1 gram of zinc deposits all the metal on a nickel gauze in thirty minutes with electromagnetic rotation (Abstr., 1907, ii, 649) and a current of 4·5 amperes. The temperature should be as low as possible. For quantities of zinc up to 0·2 gram, the strength of the current should be 4·5 amperes for fifteen minutes and then 1·5 amperes for twenty minutes. It is advisable always to test the electrolysed liquid to see whether the precipitation has been complete. L. de K.

Estimation of Zinc. A. R. Thornewell (*Chem. Zentr.*, 1907, ii, 1269; from *Chemist and Druggist*, 1907, 71, 413).—The solution should be perfectly neutral to methyl-orange and contain about 0·3 mg. of zinc per c.c. Two hundred c.c. are mixed with 25 c.c. (or more) of *N*-sodium hydroxide previously saturated with hydrogen sulphide, and the whole is diluted to 250 c.c. and well shaken. Twenty-five c.c. of the clear supernatant liquid are then mixed with 25 c.c. of *N*/10 sulphuric acid, the hydrogen sulphide is expelled by boiling, and when cold the excess of acid is titrated with *N*/10 sodium hydroxide, using methyl-orange as indicator. The zinc is then calculated from the amount of alkali absorbed. L. de K.

Volumetric Estimation of Lead. H. Bollenbach (*Zeitsch. anal. Chem.*, 1907, **46**, 582—588).—In the process described, the lead solution is titrated with permanganate in alkaline solution. Sodium hydroxide is added to the lead solution until the precipitate which at first forms is redissolved, and the whole is then diluted to a known volume. Fifty c.c. of this solution are run from a burette into a measured excess of potassium permanganate solution, placed previously in a 500 c.c. flask together with 300 c.c. of hot water and 5 c.c. of *N*/2 sodium hydroxide solution. The addition of the lead solution is accompanied with constant agitation of the permanganate mixture. After the lead solution has been introduced, the solution is cooled, diluted to 500 c.c., and the excess of the permanganate estimated, either iodometrically or by the use of a lead solution of known strength. The permanganate solution should contain 3·2 grams of the salt per litre, and be titrated against the standard lead solution. The reaction takes place according to the formula: $2KMnO_4 + 6Pb(ONa)_2 = 2MnO_2 + 3Pb_2O_3 + K_2O + 6Na_2O$. The presence of chlorides, bromides, and sulphates has no influence on the results obtained by the method, but iodides, and substances which reduce permanganate, should not be present. W. P. S.

Red Leads and their Examination. ALFRED PARTHEIL (*Arch. Pharm.*, 1907, **245**, 519—528).—According to the Deutsche Arzneibuch, IV, the purity of red lead may be tested by adding 2·5 grams of the material mixed with 0·5 gram of oxalic acid to 10 c.c. of hot nitric acid, and then adding gradually 25 c.c. of hot water; not more than 0·035 gram should remain undissolved. It is shown that this test is quite useless, owing to the formation of insoluble basic lead oxalates, lead oxalonitrate, &c. The following method is said to give better results: 10 c.c. of water, 5 c.c. of lactic acid, and 10 c.c. of 25% nitric acid are added to 2·5 grams of the red lead; a violent reaction takes place, after which the insoluble residue is weighed. W. H. G.

Colorimetric Estimation of Copper. JAROSLAV MILBAUER and VLADIMÍR STANĚK (*Zeitsch. anal. Chem.*, 1907, **46**, 644—656).—The well-known blue coloration produced when copper sulphate solution is treated with ammonia has not always the same intensity for equal quantities of the metal. Increasing quantities of ammonia or ammonium chloride diminish the depth of colour, whilst ammonium carbonate has the opposite effect, the maximum coloration obtained with ammonia and copper sulphate being increased by one-third on the addition of ammonium carbonate. Potassium hydroxide, in the presence of amines, gives with copper sulphate a coloration varying from 56% to 66% of that obtained with ammonia. Many other instances are given, but in each the coloration is less than that yielded by ammonia. An ammoniacal copper solution has a coloration one hundred and fifty times more intense than a copper sulphate solution containing the same quantity of copper. W. P. S.

Estimation of Mercury by Reduction with Hydrogen Peroxide. A. KOLB and A. FELDHOFEN (*Zeitsch. angew. Chem.*, 1907, **20**, 1977—1980).—Twenty-five c.c. of mercuric chloride solution, containing about 0·1 gram of mercury, are mixed with 25 c.c. of 2*N* hydrochloric acid and 25 c.c. of 10% tartaric acid solution. The liquid is neutralised with ammonia, and again faintly acidified with tartaric acid. The whole is heated on the water-bath, and 10 c.c. of hydrogen peroxide are added, and then from time to time another 5 c.c., so that 25—30 c.c. are used in the space of forty-five minutes. The precipitated calomel may be collected and weighed, or, better, titrated iodometrically.

The process is also useful for the separation of mercury from arsenic, antimony, tin, cadmium, and bismuth. L. DE K.

Detection of very Small Quantities of Mercuric Chloride. K. KOF and HUGO HAEHN (*Arch. Pharm.*, 1907, **245**, 529—533).—The vapour arising from a mercuric chloride solution can not only be caught on a photographic plate (compare Abstr., 1907, ii, 732), but also on moist filter paper. A moistened filter paper resting on a thin glass slide, and placed for one hundred and sixty-five hours at a distance of about 1 cm. above the surface of a 2% aqueous solution of mercuric chloride, turns dark when treated with hydrogen sulphide, except where it has been protected by the strip of glass. The photographic effect may be employed for the detection of small quantities of mercuric chloride. A distinct, white patch is obtained on developing a photographic plate which has been kept at a distance of 2 to 3 mm. from one drop of a 0·01% solution of mercuric chloride for twenty-four hours. The same effect on the plate is produced if, instead of the drop of mercuric chloride solution, one drop of the distillate, obtained by steam-distilling 100 c.c. of a 0·01% mercuric chloride solution until 100 c.c. of distillate are obtained, is employed. W. H. G.

Acidimetric Assay of White Precipitate. Erwin Rupp and F. Lehmann (*Pharm. Zeit.*, 1907, **52**, 1014).—0·2—0·3 Gram of the powdered sample is dissolved in 50 c.c. of water and 2—3 grams of potassium iodide, and the ammonia and potassium hydroxide liberated in the reaction are titrated with *N*/10 hydrochloric acid with 1—2 drops of 0·2% alcoholic methyl-orange solution as indicator. 0·2 Gram of the commercially pure article requires 15·6—16 c.c. of *N*/10 acid.

L. de K.

Complete Analysis of Mercury Cyanides. Erwin Rupp and F. Lehmann (*Pharm. Zeit.*, 1907, **52**, 1020).—One gram of the compound is dissolved, and the solution made up to 100 c.c. In order to estimate the mercury, 20 c.c. are placed in a flask, and, after adding 1—2 grams of potassium iodide and 3—5 c.c. of officinal potassium hydroxide, the mercury is reduced to the metallic state by adding 2—3 c.c. of officinal formaldehyde previously diluted with 20 c.c. of water. After shaking thoroughly for two minutes, a slight excess of acetic acid is added, and then 25 c.c. of *N*/10 iodine. When, after repeated shaking, the mercury has redissolved, 10 c.c. of dilute sulphuric acid are added, and the excess of iodine is titrated with *N*/10 thiosulphate. In order to estimate the cyanogen, 10 c.c. of the solution are mixed with a little water and 5—10 c.c. of officinal sodium hydroxide, and 25 c.c. of *N*/10 iodine are added slowly with constant agitation. The whole is allowed to remain for two to three hours, or else heated for twenty to thirty minutes in the water-bath. The liquid is diluted to 100 c.c., acidified with about 25 c.c. of hydrochloric acid, and titrated with thiosulphate; 0·1 gram of mercury cyanide = 15·87 c.c. of *N*/10 iodine. L. de K.

Borax Bead Test for Praseo- and Neo-dymium Salts. Jaroslav Milbauer (*Zeitsch. anal. Chem.*, 1907, **46**, 657—658).—The following colorations are obtained when these salts are heated in the usual way on a borax bead. Neodymium: in oxidising flame, no colour; in reducing flame, violet, if sufficient of the salt is used. Praseodymium: oxidising flame, yellowish green; reducing flame, green. The colorations are seen only when the bead is cold. Beads consisting of phosphates may be employed in place of borax.

W. P. S.

Detection and Estimation of Small Quantities of Manganese. Maurice Duyk (*Ann. Chim. anal.*, 1907, **12**, 465—466).—A pink or red coloration is obtained when a trace of manganese salt is heated with moderately alkaline potassium hypochlorite solution (10%)

to which has been added 1 drop of copper sulphate solution (10%). A precipitate of cupric oxide is produced, and the coloration is observed in the supernatant liquid. The reaction may be made quantitative by comparing the coloration obtained with that produced by known amounts of manganese. W. P. S.

Modification of Volhard's Method of Estimating Manganese. ERWIN W. MAYER (*Zeitsch. angew. Chem.*, 1907, **20**, 1980—1981).—Four modifications of the process are described, of which the following two are the most suitable for technical purposes. (1) One gram of ferromanganese, 4 grams of pig-iron, or 8 grams of steel are dissolved in nitric acid (D 1·2); the solution is evaporated to a small bulk, diluted with water, introduced into a litre-flask, and mixed with a sufficiency of zinc oxide emulsion to precipitate the iron. The whole is then diluted to 1 litre, and in 250 c.c. of the filtrate, the manganese is titrated with standard permanganate. (2) The sample is dissolved as before in nitric acid, but, before boiling down, a few drops of hydrochloric acid are added. L. DE K.

Clay Analysis. Residue Left After Volatilisation of the Silica with Hydrofluoric and Sulphuric Acids. W. R. BLOOR (*J. Amer. Chem. Soc.*, 1907, **29**, 1603—1606).—Experiments showing that the residue obtained on heating the separated silica with hydrofluoric and sulphuric acids does not consist of iron and aluminium oxides only, but contains also the other constituents of clay, such as calcium and magnesium oxides, also titanium. L. DE K.

Precipitation of Iron by Ammonia in Presence of Tartaric Acid. WILHELM STRECKER (*Chem. Zeit.*, 1907, **31**, 1217. Compare Grossmann and Schück, Abstr., 1907, ii, 819).—Ferric hydroxide is precipitated completely on addition of ammonia to a solution containing 0·1110 gram of iron in the ferric state and 0·1911 gram of tartaric acid in 53 c.c. If a larger proportion of tartaric acid is present, the precipitation is incomplete, and is finally inhibited. Attempts to isolate a complex compound from the resulting red solution containing excess of tartaric acid have been unsuccessful, as the products obtained do not have a constant composition (compare Méhu, *Jahresber. Chem.*, 1873, 569). G. Y.

Colorimetric Comparison of Copper and Nickel Solutions. JAROSLAV MILBAUER (*Zeitsch. anal. Chem.*, 1907, **46**, 656—657).—Nickel salts when treated with ammonia give a similar blue coloration to that obtained with copper salts. The author finds that one part of copper gives a coloration equal to that yielded by eighteen parts of nickel, and this fact renders the test of little use in testing very small quantities of the latter metal. In fact, a $N/100$ ammoniacal nickel solution is practically colourless, whilst a copper solution of equivalent concentration has a marked blue colour. W. P. S.

Brunck's Dimethylglyoxime Process for the Estimation of Nickel. HERRMANN GROSSMANN and BERNHARD SCHÜCK (*Zeitsch. angew. Chem.*, 1907, **20**, 1981—1982).—A reply to Brunck (Abstr., 1907, ii, 989) in which the authors uphold the accuracy of their own dicyanodiamidine process. L. DE K.

Volumetric Estimation of Bismuth. RICHARD EHRENFELD (*Zeitsch. anal. Chem.*, 1907, 46, 710—711).—The process consists in precipitating the bismuth with excess of sodium phosphate, and afterwards titrating back this excess. The bismuth solution is acidified with nitric acid to prevent the formation of basic salt, a known excess of sodium phosphate solution is added, and the mixture is diluted to a known volume. After filtration or settling, the excess of phosphate is titrated in a portion of the clear solution; uranium acetate solution is used for the titration, and sufficient sodium acetate is added to the solution to be titrated in order to remove the free nitric acid (compare Abstr., 1906, ii, 55; 1907, ii, 403).

W. P. S.

Apparatus for the Prevention of Acid Fumes in Gold and Silver Assaying. DARD (*Ann. Chim. anal.*, 1907, 12, 425—426).—A portable apparatus which may be placed in front of any kind of chimney. The hydrochloric or nitrous vapours are made to traverse a layer of fragments of white marble, and the carbon dioxide liberated is carried off by a central chimney-funnel, which will act readily owing to the heat given off by the burners. Several assays can be made simultaneously without suffering from irritating fumes.

L. DE K.

Refractometric Analysis of Organic Mixtures. ADOLF BEYTHIEN and R. HENNICKE (*Pharm. Zentr.-h.*, 1907, 48, 1005—1013).—The composition of a mixture containing any two of the following substances may be ascertained from its refractive index, the constants taken being: acetone, n_D^{15} 1·3620, n_D^{20} 1·3590; carbon disulphide, n_D^{15} 1·6315; oil of turpentine, n_D^{20} 1·4690; carbon tetrachloride, n_D^{20} 1·4630; xylene, n_D^{15} 1·49680; ethyl bromide, n_D^{15} 1·42540; chloroform, n_D^{15} 1·4466. Mixtures containing three of these substances may be analysed in the same way if one of the constituents can be estimated by a separate method. W. P. S.

Reaction of Phloroglucinol-Hydrochloric Acid with Essential Oils. KARL KOBERT (*Zeitsch. anal. Chem.*, 1907, 46, 711—714).—The author finds that only those essential oils which contain an allyl-group give a red coloration when treated with a hydrochloric acid solution of phloroglucinol. A red coloration is obtained with the essential oils of mustard, cloves, pimento, dill, orange-blossom, jaborandi leaves, tarragon, basil, bay, lavender, Peru balsam, geranium, parsley, and sassafras. W. P. S.

Detection of Methyl Alcohol in Fermented Liquids. JULES WOLFF (*Ann. Chim. anal.*, 1907, 12, 470—471).—Any alcoholic liquid containing sucrose, invert-sugar, or caramel should be redistilled before testing it for methyl alcohol by means of chromic acid, &c. (formation of formaldehyde polymerides). These substances yield formaldehyde when thus tested, and, consequently, methyl alcohol may be stated to be present in a spirit when such is not the case. W. P. S.

Normal Tubes for the Polarimetric Estimation of Sucrose. H. Rousset (*Ann. Chim. anal.*, 1907, 12, 468—470).—The use of tubes 179·2 mm. and 358·4 mm. in length is recommended for the estimation of sucrose by means of Laurent and Duboscq's or Vivien's polarimeters. The weight of the sample taken is 20 grams in 100 c.c. of water, and the percentage of sucrose is obtained without calculation. W. P. S.

Estimation of the Most Important Acids that Occur in Wine in Presence of Alcohol and Glycerol. A. Heiduschka and George Quincke (*Arch. Pharm.*, 1907, **245**, 458—461).—The method described was tested with a mixture of acetic, lactic, tartaric, malic, and succinic acids with alcohol and glycerol (and water), and found to give good results. Of such a mixture, 50 c.c. are neutralised with aqueous barium hydroxide and evaporated to 15 c.c., care being taken to keep the liquid neutral. The residue is rinsed with a little hot water into a measuring cylinder, and mixed with so much alcohol that the mixture contains 80% (by volume) of the latter. The precipitate of barium tartrate, malate and succinate is collected on a filter and washed with 80% alcohol. The filtrate, which contains barium acetate and lactate and glycerol, is freed from alcohol by evaporation, and diluted to a known volume. An aliquot portion is distilled under diminished pressure, the distillate is diluted to a known volume, an aliquot part of it is oxidised with a large excess of potassium dichromate and dilute sulphuric acid (say 5 c.c. with 50 c.c. *N*/10 dichromate solution and 50 c.c. 20% sulphuric acid) by heating for one hour in a pressure-bottle in the water-bath, and the excess of dichromate is estimated by adding potassium iodide and titrating with *N*/10 sodium thiosulphate solution; in this way, the glycerol is determined. An aliquot portion of the filtrate is oxidised in the same way without being distilled first; in this way, the sum of the glycerol and the lactic acid is determined ($C_3H_6O_3$ requires 2O).

The precipitated barium salts, with the filter, are brought into a measuring cylinder, stirred with 20 c.c. of water containing some sulphuric acid, diluted with alcohol to 100 c.c., and filtered. Of the filtrate, 80 c.c. are mixed with 0·5 c.c. of 20% potassium acetate solution, 15 grams of powdered potassium chloride, and 2 c.c. of acetic acid, and allowed to remain for twelve hours; the precipitated potassium hydrogen tartrate is then filtered off, and its amount determined by titration. The filtrate is freed from alcohol by evaporation, mixed with 50 c.c. of dilute sulphuric acid, and titrated with *N*/10 potassium permanganate solution; in this way, the malic acid is determined ($C_4H_6O_5$ requires 6O). The oxidised liquid is evaporated to dryness with quartz sand, the residue is extracted with ether, the extract is evaporated, and the succinic acid left is weighed.

The alcohol is estimated by neutralising another portion of the original mixture, distilling off the alcohol, and oxidising a portion of the distillate with dichromate and sulphuric acid as described above (C_2H_6O requires 2O).

The acetic acid is estimated by distilling another portion of the original mixture, and titrating the distillate. C. F. B.

Estimation and Colour Reactions of Glycuronic Acid. K. U. LEFÈVRE and BERNHARD TOLLENS (*Ber.*, 1907, **40**, 4513—4523; *Zeitsch. Ver. deut. Zuckerind.*, 1907, **57**, 1097—1110. Compare Neuberg and Neimann, Abstr., 1905, ii, 426; Tollens, *ibid.*, 559).—When boiled with hydrochloric acid, glycuronic acid yields furfuraldehyde and carbon dioxide (Günther and Tollens, Abstr., 1890, 1352; Chalmot and Tollens, Abstr., 1891, 568; Mann and Tollens, Abstr., 1895, ii, 335). On this reaction, the authors have based two methods of estimating glycuronic acid; in the first, the furfuraldehyde is converted into, and weighed as, its phloroglucide; in the second, the carbon dioxide evolved is absorbed and weighed. The weight of the phloroglucide is one-third and that of the carbon dioxide one-quarter of the glycuronic acid. Details are given of estimations with glycuronic acid, euxanthic acid, magnesium euxanthate, and sodium urochloralate in which the error does not exceed 1—1·5%. By the first method, piuri (Indian-yellow) is found to contain 18% to 19·5% of glycuronic acid, equivalent to 43·1% to 46·7% of euxanthic acid; Graebe, Aders, and Heyer (Abstr., 1902, i, 39) found piuri to contain 39% to 46% of euxanthic acid. To estimate pentoses and glycuronic acid in presence of each other, the amount of glycuronic acid is determined by the carbon dioxide method and one-third of its weight substracted from the phloroglucide, the remainder of this being equivalent to the pentoses.

Piuri is found to contain 1·39% of nitrogen which is only partly accounted for by the presence of small amounts of hippuric acid, and a substance which is probably *m*-toluic acid; another specimen contained benzoic acid.

Contrary to Bial's (Abstr., 1902, ii, 703) and Sachs's (Abstr., 1907, ii, 135) statements, glycuronic acid reacts with Bial's orcinol reagent, but more slowly than the pentoses and only on continued heating of the reaction mixture. The green coloration can be detected with 0·0025 mg. of xylose, 0·005 mg. of arabinose, and 0·025 mg. of glycuronic acid. With phloroglucinol in presence of ferric chloride, glycuronic acid forms a dirty red, turbid solution, which gives a spectrum with a band at the *D*-line less marked than the band lying to the right of the *D*-line in the pentose-phloroglucinol spectrum.

G. Y.

Detection and Estimation of Benzoic Acids in Ketchups, Fruits, and Ciders. HARRY S. REED (*J. Amer. Chem. Soc.*, 1907, **29**, 1626—1629).—The sample is acidified with sulphuric acid, the benzoic acid is extracted with chloroform, and the latter is evaporated in a current of air in a special apparatus. The residue is then heated at 260° in a current of air, and the volatilised benzoic acid absorbed in aqueous sodium hydroxide. From this, it is recovered by acidifying the solution and shaking with chloroform, and the residue left on evaporation is then tested for benzoic acid by converting it first into *m*-dinitrobenzoic acid and this into ammonium diaminobenzoic acid, which has a characteristic appearance.

The quantitative estimation is based on the fact that calcium benzoate is fairly soluble in cold water. The chloroform residue of the acid is treated with a definite amount of milk of lime, and the benzoic acid is calculated from the amount of calcium found in the solution after allowing for dissolved calcium oxide, as found by a blank experiment. L. DE K.

Estimation of Fat in Skimmed Milk. R. LEZÉ (*Compt. rend.*, 1907, **145**, 817—818).—Three litres of the skimmed milk are heated to a temperature of 40° and treated with 60 c.c. of a solution prepared by dissolving 20 grams of sodium hydroxide in 180 c.c. of ammonia and diluting to a volume of 250 c.c. The treated milk is then subjected to centrifugal action, a small apparatus being used, and the cream thus separated is used for the analysis, the estimation of the fat being made by Gerber's process. W. P. S.

Estimation of Some Alkaloids by Means of Picrolonic Acid. HERMANN MATTHES and O. RAMMSTEDT (*Zeitsch. anal. Chem.*, 1907, **46**, 565—574).—Cotarnine, codeine, and morphine give insoluble precipitates when treated with picrolonic acid, and this reaction may be used for the estimation of these alkaloids in preparations such as tablets, powders, &c. A tablet, or a quantity of the powder, equivalent to about 0·05 gram of alkaloid is dissolved in 10 c.c. of water, the solution is filtered, and, after washing the filter and insoluble residue, the filtrate is treated with 2·0 c.c. of $N/10$ alcoholic solution of picrolonic acid. The mixture is placed aside for fifteen hours at the ordinary temperature, after which time the precipitate is collected on a weighed filter, washed with water, dried at 110°, and weighed. The precipitates have the following formulæ: cotarnine picrolonate, $C_{12}H_{15}O_4N,C_{10}H_8O_5N_4$; codeine picrolonate,

$$C_{18}H_{21}O_3N,C_{10}H_8O_5N_4,$$

and morphine picrolonate, $C_{17}H_{19}O_3N,C_{10}H_8O_5N_4$ (compare Abstr., 1907, ii, 592). W. P. S.

Estimation of Cystine in Urine. J. F. GASKELL (*J. Physiol.*, 1907, **36**, 142—149).—The addition of acetone renders the acetic acid method of estimating cystine a trustworthy one. In five cystine calculi, cystine crystallised in hexagons, but it may crystallise in other forms. The specific rotation of cystine dissolved in ammonia is −97·5°, and dissolved in hydrochloric acid −223°. Hair-cystine and calculus-cystine are identical. W. D. H.

Estimation of Indigotin in Indigo-yielding Plants. CYRIL BERGTHEIL and RICHARD V. BRIGGS (*J. Soc. Chem. Ind.*, 1907, **26**, 1172—1174).—The modifications of the persulphate and isatin methods suggested by Orchardson, Wood, and Bloxam (Abstr., 1907, ii, 415) are considered by the authors to be useless in ordinary practice, both

leading to untrustworthy results unless the exact indican-content of the sample is known previously and the methods adjusted accordingly.
W. P. S.

Analysis of Indigo (III) and of the Dried Leaves of Indogofera Arrecta and Indigofera Sumatrana. R. Gaunt, F. Thomas, and W. Popplewell Bloxam (*J. Soc. Chem. Ind.*, 1907, **26**, 1174—1182). —As the result of continued use of the tetrasulphonate method, the authors consider that the claims for accuracy made for this process (Abstr. 1906, ii, 819) are fully substantiated. For the analysis of the leaf, the isatin method is, at present, the only trustworthy one; the product obtained from it has been proved to be almost chemically pure indirubin. As the formation of indirubin can only originate from the indoxyl liberated from the indican on hydrolysis, the quantity of indirubin obtained must be a true expression of the amount of this substance which is present. W. P. S.

Titration of Tannin by Means of Iodine. Ferdinand Jean (*Ann. Chim. anal.*, 1907, **12**, 426—427).—A reply to Cormimbœuf (Abstr., 1907, ii, 994). The author states that the iodine process is trustworthy, but the titration should take place in a solution containing excess of sodium hydrogen carbonate. L. de K.

Vanillin-Hydrochloric Acid as a Test for Albumin and Tryptophan. Leopold Rosenthaler (*Chem. Zentr.*, 1907, ii, 946; from *Apoth. Zeit.*, 1907, **22**, 678).—Winckel has shown (*Apoth. Zeit.*, 1905, **22**, 209) that several fruit juices and substances containing ferments give a violet coloration with vanillin and hydrochloric acid, and has concluded that this is a characteristic reaction of ferments. In the present paper, it is pointed out that albumin, globulin, and casein give a violet coloration with vanillin and hydrochloric acid; likewise also tryptophan, but not phenylalanine, tyrosine, histidine, or pyrrolidine-2-carboxylic acid. W. H. G.

Estimation of Pepsin by Means of Edestin. Ernst Fuld and Louis A. Levison (*Biochem. Zeitsch.*, 1907, **6**, 473—501).—The method is based on the principle that edestin (the crystalline protein from hemp seeds) is precipitated by sodium chloride from its solution in 0·3% hydrochloric acid, but that the products of its digestion are not so precipitated. Accordingly, the minimum quantity of gastric juice is found, which, when added to a definite volume of the edestin solution, prevents the formation of a precipitate when solid sodium chloride is added after half an hour's incubation. G. B.

General and Physical Chemistry.

Influence of Temperature on the Optical Properties of Dissolved Substances. C. CHÉNEVEAU (*Compt. rend.*, 1907, **145**, 1332—1334. Compare Abstr., 1907, ii, 920).—The index of refraction of a dissolved substance varies slightly with the temperature; the variation of the optical constant K [$K = \Delta/c$, where $\Delta = n_s - 1$ or $(n_s^2 - 1)/(n_s^2 + 2)$, and c is the concentration in grams per litre] with the temperature is due to the change of volume of the solution, and the relation is expressed by the equation $K_t' = K_t\ [1 + m(t' - t)]$, where m is the mean coefficient of expansion of the solution. The calculated and observed values of the optical constant in the cases of solutions of sodium chloride, potassium chloride (Bender, Abstr., 1900, ii, 461; 1902, ii, 437), potassium nitrate, and chloral hydrate are tabulated in the original. M. A. W.

Rotatory Power in Solutions. THOMAS S. PATTERSON (*Ber.*, 1908, **41**, 113—120).—Polemical. A reply to Walden's criticisms (Abstr., 1907, ii, 519) of Patterson and Thomas (Abstr., 1907, ii, 322). See also Walden (Abstr., 1906, ii, 209). E. F. A.

Origins of Stereochemistry. EMANUALE PATERNÒ (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 717—719).—A question of priority. T. H. P.

Optical Properties and Electron Theory. H. ERFLE (*Ann. Physik*, 1907, [iv], **24**, 672—708*).—The dispersion of benzene, α-bromonaphthalene, and methyl iodide has been measured for wavelengths in the visible spectrum. The results are discussed in reference to Drude's theory of dispersion, according to which it is possible to calculate a limiting value (p) for the number of freely vibrating electrons in the molecule, this value depending on the composition and constitution of the molecule in the same way that the refraction equivalent does. The values of p are calculated for a large number of compounds, the dispersion of which was measured by Landolt, Brühl, and others, and, from these molecular values, constants are deduced which represent the values of p for various atoms and radicles, and also for double and triple linkings and for the benzene and naphthalene rings. In aliphatic compounds, the various atoms have the same value of p as they have in aromatic compounds when directly attached to the benzene ring. When present in aromatic compounds and not directly attached to one of the six carbon atoms of the ring, the values of p are different. In nitrogen compounds, the values of p for carbon, hydrogen, and oxygen are different from the values found in compounds not containing nitrogen. Between 10° and 30°, the numbers are independent of the temperature.

H. M. D.

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* And *Zeitsch. physikal. Chem.*, 1907, **61**, 399—421.

Spectra of the Alkali [Metals]. CARL RUNGE (*Physikal. Zeitsch.*, 1908, **9**, 1—2).—It is pointed out that the new series of lines observed by A. Bergmann (*Diss.*, Jena, 1907) in the ultra-red region of the emission spectra of potassium, rubidium, and cæsium are similarly related to the lines in the first subsidiary series as the lines in the principal series are to those in the second subsidiary series.

H. M. D.

The Variations of the Absorption Bands of Didymium and Erbium Salts in a Magnetic Field. JEAN BECQUEREL (*Compt. rend.*, 1907, **145**, 1412—1415. Compare Abstr., 1906, ii, 317, 421; 1907, ii, 147).—The author has extended his investigation on the variations of the absorption bands of rare earth salts in a magnetic field at low temperatures (this vol., ii, 3), and in the present paper the results obtained with didymium chloride and nitrate and mixtures of the two, didymium sulphate oxalate, and fluoride and erbium chloride are recorded. The soluble salts were dissolved in alcohol, and the insoluble salts suspended in alcohol and solidified by means of liquid air. With the exception of the oxalate and fluoride of didymium, the absorption bands of all these salts suffered displacement when placed in a magnetic field, and the author draws the conclusion that the influence of the magnetic field on the change of period of the corpuscles producing a band is independent of the temperature, and also of other conditions which tend to modify the band; the amount of displacement of a band in a magnetic field of known strength appears to be a characteristic property of the oscillating system.

The author is of opinion that it is premature to put forward any hypothesis in explanation of the curious result that rays which are circularly polarised in the same direction are not all displaced in the same sense by a magnetic field.

M. A. W.

Influence of Temperature Changes on the Absorption in Solid Substances. JEAN BECQUEREL (*Physikal. Zeitsch.*, 1907, **8**, 929—942).—The author has investigated the changes which take place in the absorption bands of certain crystals containing rare earths (xenotime, tysonite) when these are subjected to different temperatures. The bands were examined in most cases at $+25°$ and at $-188°$.

In general, the absorption bands are shifted towards the smaller wave-lengths when the temperature is lowered, although certain bands move in the opposite direction. The width of the bands diminishes with fall of temperature, and in most cases the intensity of the absorption increases. If the widths of the bands are measured by the distances between the two points which correspond with maximum disturbance on the curve of dispersion, it is found that these are proportional to the square root of the absolute temperature.

Some observations on the emission spectra of phosphorescing substances at the temperature of liquid air indicate that similar temperature effects are to be met with in this case.

H. M. D.

Cause of the Emission of the Principal Series Lines of the Alkali Metals and the Doppler Effect in Canal- and Anode-Rays. CARL FREDENHAGEN (*Physikal. Zeitsch.*, 1907, **8**, 927—929).—Another explanation is given of the experimental observations which have led Gehrcke and Reichenheim (*Verhandl. Phys. Ges.*, 1906, **8**, 559, and 1907, **9**, 76) to the view that the *D*-lines are emitted by positively charged sodium atoms. The facts also agree with the view that collisions between sodium and oxygen atoms are the cause of the *D*-line emission. This theory derives strong support from the experimental observation that, whilst the intensity of the anode-ray emission from anodes containing sodium compounds increases as the exhaustion becomes more complete, the *D*-line emission decreases in intensity. It is also consistent with Lenard's observation that the *D*-lines are due to electrically neutral particles. H. M. D.

Reactions in Ultra-violet Light. HERMANN THIELE (*Ber.*, 1907, **40**, 4914—4916).—In the experiments described, the source of light was a mercury lamp constructed of quartz; the vessels were likewise composed of quartz. Hydrogen peroxide is formed in small quantities when water is exposed to the ultra-violet rays, but a 0·3% solution of hydrogen peroxide is decomposed quickly. Formic acid is decomposed into carbon dioxide, carbon monoxide, and an inflammable gas. The formation of water from hydrogen and oxygen, of carbon dioxide from carbon monoxide and oxygen, of chlorine from hydrogen chloride and air (Deacon's process), and of nitrite from *N*/10 potassium nitrate are accelerated when exposed to ultra-violet rays. W. R.

Phosphorescence at Low Temperatures. JOSEPH DE KOWALSKI (*Compt. rend.*, 1907, **145**, 1270—1272).—The phosphorescence excited by ultra-violet light in alcoholic solutions of the nitrates of the rare earths and of phenanthrene, anthracene, and anthraquinone, when cooled in liquid air, and its persistence after extinction of the exciting light, has been studied. When the solutions (which have solidified) of the nitrates of the rare earths are exposed to the light from a mercury arc lamp (taking a current of 4 amperes at 25 volts), they become phosphorescent, and the phosphorescence has a relatively long duration (five minutes) after extinction of the lamp. The phosphorescence of the erbium solution is green, of the samarium greenish-yellow, and of the neodymium violet, but, except in the case of samarium, the intensity is too small to permit measurement of the emission spectra. The latter for samarium is composed of a series of fine lines. The solidified solution of phenanthrene has a greenish-yellow, of anthracene a blue, and of anthraquinone a bright green phosphorescence. The phosphorescence of these solutions is sufficiently intense for spectroscopic examination, and their spectra are found to consist of thin bands and fine rays. Apparently clearness and fineness of the bands are characteristic of phosphorescence emission spectra at low temperatures.

The intensity of the phosphorescence varies with the concentration of the solution; saturated solutions exhibit very little phosphorescence, probably owing to crystallisation of the solute when the solution solidifies. The intensity of the phosphorescence of solutions of anthraquinone and anthracene diminishes gradually with their concentration, but that of phenanthrene solution reaches a maximum at a concentration of about 0·2%. The non-observance of a maximum intensity in the first two cases is perhaps due to the slight solubility of anthracene and anthraquinone in alcohol. E. H.

Measurement of the Absorption Coefficients of Radium Emanation in Solutions and Mixtures. MARTIN KOFLER (*Physikal. Zeitsch.*, 1908, **9**, 6—8).—The influence of foreign substances on the solubility of radium emanation in water at 18° has been examined. Metallic salts and sucrose diminish the solubility, the diminution being greater the greater the concentration of the dissolved substance. When the absorption coefficients for solutions of different metallic salts of the same density are compared, it is found that the coefficient increases as the molecular weight of the dissolved substance increases. The solubility of the emanation in ethyl alcohol-water mixtures increases rapidly with the proportion of ethyl alcohol in the mixture. H. M. D.

Radioactivity of Air Over the Open Sea. CARL RUNGE (*Chem. Zentr.*, 1907, ii, 1353; from *Nachr. K. Ges. Wiss. Göttingen*, 1907, 211—229).—A wire, 18 metres long, charged to a very high negative potential, was fixed to the mast of a vessel on the open sea. After thirty hours, it was wound on a small frame, and its activity measured by the electroscope. The cause of the activity cannot be due only to radium emanation, because a noticeable activity remained after that induced by radium must have disappeared. The values obtained do not agree with the rate of decay of activity induced by thorium. Comparative experiments with radium emanation performed in the laboratory indicate that over the open sea some other source of radioactivity must exist; the curve of decay, logarithmically plotted, resembles somewhat that of the activity induced by radium, but is at first steeper and finally flatter.

The presence of radium and thorium emanations alone serves to account for the activity induced in a wire on the Hainberge near Göttingen. C. S.

Specific Radioactivity of Uranium. HERBERT N. McCOY and W. H. ROSS (*J. Amer. Chem. Soc.*, 1907, **29**, 1698—1709).—The values of the specific activity of uranium in pure uranium compounds and in minerals which have been obtained previously have been determined from measurements with a distance of 3·5—4·5 cm. between the active film and the charged electrode. Since it has been shown by Bragg and Kleeman (*Phil. Mag.*, 1905, [vi], **10**, 318) that the ranges of radium-*A* and radium-*C* both exceed 4·5 cm., it follows that the value given for the specific radioactivity of uranium in minerals is too low. Measurements have now been made with a new form of gold-leaf electroscope, which allows a distance of 8·5 cm. between the active film and the electrode. With this instrument, the activity of a pure uranium compound was the same at 4·5 cm. as at 8·5 cm. from the electrode, but the film of a uranium mineral was about 4% more active at 8·5 cm. than at 4·5 cm. For these determinations, the films were deposited on perfectly flat surfaces, and the observed activity was corrected for deficiency due to loss of emanation.

The specific activity of uranium in minerals is 3616, and in pure uranium compounds 796. Hence, for equal uranium content, minerals free from thorium are 4·54 times as active as pure compounds. The relative activity of equilibrium amounts of uranium and radium in a mineral is 1·87. The range of uranium is about 3·4 cm., and it is considered probable that there is a uranium product which emits α-rays with a range of 3·25 cm.

It is suggested that the supposed genetic relationship of actinium to uranium is due to the disintegration of uranium-X in two ways, one giving β-rays and the inactive product which finally produces radium, and the other, a much slower change, giving α-rays and actinium. E. G.

Specific Radioactivity of Thorium and the Variation of the Activity with Chemical Treatment and with Time. HERBERT N. McCOY and W. H. ROSS (*J. Amer. Chem. Soc.*, 1907, **29**, 1709—1718).—In an earlier paper (Abstr., 1906, ii, 415) on the radioactivity of thorium minerals, it was shown that, after deducting the activity due to uranium from the total activity, the residual activity was proportional to the percentage of thorium present. The same conclusion has been arrived at by Boltwood and by Dadourian (Abstr., 1906, ii, 415).

Determinations of the specific activity of thorium have been made with films deposited on flat plates and under such conditions that all the α-rays reach their maximum ranges in air (compare preceding abstract), and the value 1009 has been obtained.

Experiments have been carried out with the object of finding a method of separating radiothorium from thorium by chemical means, but without success. The reduction in the activity of thorium which is effected by certain chemical processes is due to the removal of mesothorium and the consequent gradual decay of the radiothorium. If all the mesothorium is removed in the preparation of pure thorium dioxide, the activity of the latter will fall to a definite minimum. From the activity of a specimen supposed to have reached this minimum, it has been calculated that the period of mesothorium is 5·5 years; the quantitative changes of activity with time of a number of samples of the oxide have been found to agree with the values calculated on this assumption. E. G.

Wehnelt Cathode in High Vacua. FREDERICK SODDY (*Physikal. Zeitsch.*, 1908, **9**, 8—10).—Wehnelt has shown that currents of considerable intensity can be passed through a highly exhausted tube containing a platinum cathode coated with a layer of calcium oxide heated to a temperature of 1300—1400°. Experiments have been made to ascertain whether this phenomenon is, as generally assumed, independent of the degree of exhaustion of the apparatus.

A tube containing a Wehnelt cathode and a calcium anode was filled with oxygen in order to remove argon, and then, by connecting the tube with an apparatus containing strongly heated calcium, a high degree of exhaustion was produced. The electrodes were then connected with a battery of 250 volts, and a current of 1·2 amperes was passed intermittently in order to allow the gases evolved by the heated cathode and the tube to be absorbed by the heated calcium anode. The current was finally allowed to pass continuously, whereby the calcium anode was heated to its vaporisation temperature. At this point, the current ceased to pass through the tube, and, although a feeble intermittent glow was subsequently evident, the discharge was insufficient to affect the amperemeter. By means of an induction coil, it was found possible to pass a current between the heated cathode and a second anode, and when this became hot by the continued passage of the current from the coil, a sufficient quantity of gas was evolved within the tube to enable the large current of 1·2 amperes to pass again from the cathode to the first anode.

These facts indicate that the phenomenon associated with the Wehnelt cathode cannot be observed in very high vacua. In contrast to the view that the large currents obtainable with this electrode are carried entirely by the emitted electrons, the author maintains that the observed facts indicate that these currents are to be referred almost exclusively to the residual gas, a very small fraction only being carried by the electrons as such. H. M. D.

Electrochemical Equivalent and Temperature. FRIEDRICH KOHLRAUSCH and RUDOLF H. WEBER (*Ber. deut. physikal. Ges.*, 1907, 5, 681—696).—Experiments are recorded the object of which was to ascertain if temperature has any measurable influence on the value of the electrochemical equivalent. The method of experiment consisted in passing a current through a solution contained in a U-tube, the lower part of which was kept cool by immersion in ice-cold water, whilst the solution in the upper portions of the two limbs was heated by the current passing through it. If the electrochemical equivalent varies with the temperature, then at the surface of separation of the hot and cold solutions ions should be set free, and these may be recognised if suitable indicators are present in the solution. To prevent the disturbances resulting from convection currents at the surface of separation, it was found necessary to gelatinise the solutions by the addition of arrowroot.

The solutions examined were 40% sodium nitrate, 40% sodium chlorate, 30% potassium bromide, and 26% potassium iodide, litmus being added to the first three solutions to indicate the liberation of alkali metal or acid ions at the surface of temperature change. The starch in the gelatinised solution furnishes the indicator for any liberated iodine ions in the potassium iodide solution.

The results obtained are in all cases negative, and indicate that, if the electrochemical equivalent varies with the temperature at all, the variation must be less than one-millionth per 1° in the case of sodium nitrate, sodium chlorate, and potassium bromide, and less than one ten-millionth per 1° in the case of potassium iodide. If there should be a temperature-coefficient common to all electrolytes, then this is presumably smaller than the lowest observed maximum value

($<1 \cdot 10^{-7}$). To this extent, the electrochemical equivalent may be regarded as independent of the temperature. H. M. D.

Emission of Negative Ions by Heated Metals and by Heated Calcium Oxide. FRITZ DEININGER (*Ber. deut. physikal. Ges.*, 1907, **5**, 674—680[*]).—The emission of negative ions by heated platinum, carbon, tantalum, and nickel, and by the same elements when covered by a layer of calcium oxide, has been investigated by measuring the saturation currents at a series of temperatures. In all cases, Richardson's formula expresses the relationship between the saturation current and the temperature of the heated material. The number of ions emitted by the uncovered elements increases in the order: nickel, platinum, tantalum, carbon. When the heated wires are coated with a thin layer of calcium oxide, the differences disappear, the number of ions emitted, although very much greater, being in all cases the same.

The author concludes that the emission of negative ions by heated metals depends very much on the nature of the metallic surface, and the frequently observed irregularities are to be attributed to variation in the nature of the surface layers. H. M. D.

Measurement of the Variation of Specific Heat with Temperature. ERNST LECHER (*Ber. deut. physikal. Ges.*, 1907, **5**, 647—656).—A new method of measuring specific heats of metals at high temperatures is described. The metal, in the form of a wire 3—4 mm. in diameter, is contained in an evacuated porcelain tube heated in an electric furnace. A measured, alternating electric current is passed for a known interval of time through the wire, and the rise of temperature thereby produced is measured by means of a thermo-element in contact with the metal under examination. Although the method only yields relative specific heat values, it is particularly suitable for the determination of the variation of the specific heat with the temperature, for it gives relative specific heats at definite temperatures, whereas ordinary calorimetric methods give only mean specific heat values over considerable ranges of temperature.

The results obtained for nickel and iron are recorded in the form of curves. From these, it appears that the specific heat of nickel rises with the temperature and attains a maximum at 320°. A similar maximum is found for iron at about 740°. In a footnote, the author alludes to the possibility that the observed maxima may be connected with molecular changes in the metals, and prefers to regard the measured quantities as the total quantities of heat required for the change in state (Erwärmungsenergien). H. M. D.

Apparatus for Distillation in High Vacua. H. BÜELER DE FLORIN (*Chem. Zeit.*, 1908, **32**, 56).—In the apparatus, which is described and figured, the side tube of the distilling bulb is fused into the receiver, thus doing away with cork or rubber connexions, and is surrounded by an extension of the air-bath in which the bulb is heated. The receiver is jacketed, and may be heated with water or steam to assist in the removal of solidified distillates. G. Y.

A Water Thermostat for the Normal Temperature of 15°. PODA (*Zeitsch. angew. Chem.*, 1907, **20**, 2245—2247).—The author has devised an arrangement for maintaining a water-bath at 15°, the variations in temperature amounting to less than 0·1 of a degree. For details, the description and diagram in the original must be consulted. G. Y.

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[*] And *Ann. Physik*, 1908, [iv], **25**, 285—308.

New Vapour Pressure Interpolation Formula. EMIL BOSE (*Physikal. Zeitsch.*, 1907, 8, 944—951).—The relationship between vapour pressure and temperature is accurately represented by the equation $\log p = A + B.1/T + C.1/T^2 + D.1/T^3$ if low values of the absolute temperature, T, are excluded. The experimentally determined vapour pressure values for eight substances (ethyl alcohol, water, fluorobenzene, methyl acetate, ethyl formate, *n*-pentane, chlorine, and ethyl ether) at temperatures from $-20°$ to $+140°$ are compared with the requirements of this formula, and also with those of the Nernst formula: $\log p = A + BT + C\log T + D.1/T$. The mean relative deviations of the experimental vapour pressure values for these eight substances from those calculated are smaller in the case of the exponential formula than in that of Nernst's formula if ethyl ether is excepted. If curves representing the deviations as a function of the temperature are plotted, the closer agreement of the experimental values with those calculated from the new formula is strikingly evident. This is particularly the case for water, fluorobenzene, methyl acetate, and ethyl formate, the deviations being, not only small, but quite irregular and attributable to small errors in the determination of the vapour pressures. The exponential formula is more accurate for extrapolation to higher temperatures, but for extrapolation to low temperatures the values calculated from Nernst's formula are more accurate. H. M. D.

Thermodynamics of Non-homogeneous Mixtures. II. EMIL BOSE [with MISS B. MAY CLARK] (*Physikal. Zeitsch.*, 1907, 8, 951—957).—A further theoretical consideration of the relationship between the vapour pressures of partially miscible liquid mixtures and the heat change which takes place on mixing the two liquids.

Measurements of the heat change on mixing *iso*butyl alcohol and water have been made at three different temperatures. At 20·76°, the two liquid phases contain respectively 10% and 83% of *iso*butyl alcohol; at 50·74°, 8% and 82%, and at 60·72°, 6·5% and 81%. The heat change which accompanies the formation of 1 gram of saturated solution of *iso*butyl alcohol in water is at the three temperatures, $+2·85$, $+0·44$, and $-0·13$ cals. respectively. The heat change accompanying the formation of 1 gram of saturated solution of water in *iso*butyl alcohol at the same three temperatures is $-1·97$, $-3·61$, and $-4·36$ cals. respectively.

The partial pressures of the two components are calculated from the thermal measurements, and it is found that the sums of the partial pressures are in close agreement with the total vapour pressures determined experimentally by Konowaloff. H. M. D.

Molecular Attraction. VII. Examination of Seven Esters. JAMES E. MILLS (*J. Physical Chem.*, 1907, 11, 594—622. Compare Abstr., 1907, ii, 226).—The validity of the equation $(L - E)/(\sqrt[3]{d} - \sqrt[3]{D})$ = constant is further tested by reference to experimental data available for propyl formate, ethyl acetate, methyl propionate, propyl acetate, ethyl propionate, methyl butyrate, and methyl *iso*butyrate. The results are very favourable, and therefore furnish additional support to the view that the attraction between the molecules of a liquid varies inversely as the square of their distance. Crompton's formula for the heat of vaporisation has been further examined ; the values given by this formula are uniformly too high at low vapour pressures, but at high vapour pressures in the vicinity of the critical temperature the formula is accurate.

Some relations at the critical temperature, already discussed in earlier papers, are confirmed for the seven esters which have been examined. J. C. P.

Thermochemical Data relating to the Chlorinated Compounds derived from Millon's Base. H. GAUDECHON (*Compt. rend.*, 1907, **145**, 1421—1425. Compare Abstr., 1907, ii, 621, 667).—The monohydrate of dimercuriammonium chloride, $(NHg_2Cl)_2,H_2O$ (compare André, Abstr., 1899, 837), prepared either by neutralising the base, $(NHg_2)_2O,4H_2O$, with $N/2$ HCl or by dehydrating the dihydrate, $(NHg_2Cl)_2,2H_2O$, or by the limited action of boiling water on the compound NHg_2Cl,NH_4Cl or $NHg_2Cl,3NH_4Cl$, is a yellow, amorphous substance. The dihydrate, $(NHg_2Cl)_2,2H_2O$, prepared by the action of ammonia on mercuric chloride or on the compound $3HgO,HgCl_2$, is also amorphous. From the determination of the heat of neutralisation of the base, $(NHg_2)_2O,4H_2O$, with $N/2$ HCl, and the heat of solution of the salt, $2NHg_2Cl,H_2O$ or $2NHg_2Cl,2H_2O$, in potassium cyanide, the heat of formation of the salt, $2NHg_2Cl$ (solid), from the base $(NHg_2)_2O$ (solid), and hydrochloric acid (dissolved) is 50·9 Cal. ; the corresponding values in the case of potassium hydroxide, barium oxide, and silver oxide are 27·4 Cal., 27·7 Cal., and 41·2 Cal. respectively, and this explains why Millon's base can displace potassium, sodium, and barium from solutions of their chlorides.

The heat of formation of the compound NHg_2Cl,NH_4Cl or $NHg_2Cl,3NH_4Cl$ (solid) from the salt, NHg_2Cl (solid), is 15·6 Cal. or 18·4 Cal. respectively, and is comparable to the heat of formation of such complex salts as the platinichlorides, platinibromide, or mercuricyanides. M. A. W.

Density of Liquids below Zero. J. TIMMERMANS (*Bull. Soc. chim. Belg.*, 1907, **21**, 395—402).—The author has studied the variation of density (compared with that of water at 4°) with change in temperature of the liquids, methyl and ethyl alcohols, ethyl ether, acetone, *iso*butyric acid, ethyl acetate, acetonitrile, ethyl bromide, chloroform, *iso*pentane, toluene, chlorobenzene, and pyridine, below 0°. The liquids were repeatedly distilled, using a Young column, until their boiling points were constant to 0·01°, and were finally distilled from a powerful dehydrating agent. The variation in density was determined by a dilatometer method, temperatures being measured by a Callendar platinum resistance thermometer. The results obtained are subject to a maximum error of ± 0·0005. For the liquids studied, the density below 0° varies directly with the temperature (below zero). A table is given showing the temperature interval studied, the density of the liquid at 0° (D_4^0), the coefficient of increase in density per degree lowering of the temperature, and the densities (1) found experimentally, (2) calculated by the author's formula, and (3) calculated by Young's formula at a definite temperature arbitrarily chosen for each liquid. In no case was a maximum density observed. E. H.

Vapour Density Determinations at very High Temperatures. H. von Wartenberg (*Zeitsch. anorg. Chem.*, 1907, **56**, 320—336. Compare Abstr., 1906, ii, 161; Nernst, Abstr., 1903, ii, 636).—The vapour densities of a number of elements, mainly metals, have been determined in the neighbourhood of 2000° by Nernst's method (*loc. cit.*). Some slight modifications of the earlier arrangements are described; in particular, the iridium bulb was coated inside and outside repeatedly with a paste of magnesia and magnesium chloride, and heated strongly after each addition. This coating proved much more satisfactory than that used previously. Argon or nitrogen was used for filling the bulb. In addition to the measurements in the neighbourhood of 2000°, some experiments were made at lower temperatures, the temperatures up to 1600° being determined by means of a thermocouple in the bottom of the bulb.

The apparent average molecular weights at the temperatures indicated are as follows: bismuth, 224 at 2070°; antimony, 128 at 2070°; selenium, 200 at 1850°, 120 at 2100°; tellurium, 160 at 2100°; lead, 225 at 1600—1870°; thallium, 220 at 1320—1690°; zinc, 72 at 1200—2070°; sulphur, 50 at 2070°. The agreement of separate observations with the same substance is only moderate.

The results show that all the metals so far investigated are monatomic in the state of vapour at the highest temperatures.

From the temperatures at which rapid volatilisation of the metals takes place, the following boiling points have been estimated approximately: thallium, 1280°; lead, 1580°; silver, 2050—2100°. Tin, gold, copper, magnesium, and aluminium boil above 2200°.

The results obtained by the author and by previous observers for the dissociation of the elements of the sulphur and phosphorus groups are tabulated. By means of Nernst's equation connecting equilibrium and temperature, the energy required for the dissociation of a diatomic into a monatomic molecule is estimated at 90,000 Cal. for the elements of the sulphur group, and 80,000 Cal. for those of the phosphorus group.

Incidentally, it is shown that, contrary to the statement of Cooke (Abstr., 1906, ii, 539), the density of zinc is the same in argon as in nitrogen, so that the suggestion of this observer, that zinc may form a compound with argon, is incorrect. Attempts to obtain argon in combination with aluminium or magnesium were unsuccessful, neither did argon combine with iridium under the conditions of the experiments. G. S.

Application of the Method of Limiting Densities to Organic Vapours. Philippe A. Guye (*Compt. rend.*, 1907, **145**, 1330—1331).—Using the experimental values obtained by Ramsay and Steele (Abstr., 1903, ii, 635) for the densities and compressibilities of the vapours of the organic compounds, ethyl ether, hexane, methyl alcohol, di*iso*butylbenzene, *n*-octane, and toluene, the authors have calculated the corresponding values of the gas constant R from the relation $R = M/L(1 - A_0^1)$. The results show that the values of R are not constant, but decrease as the critical temperatures of the vapours under consideration increase; and the author concludes, provisionally, that the extrapolation methods which give the coefficient A_0^1 are insufficient (compare Berthelot, Abstr., 1898, ii, 502; 1907, ii, 154).

M. A. W.

Viscosity of Solutions. I. CLERK RANKEN and WILLIAM W. TAYLOR (*Trans. Roy. Soc. Edin.*, 1906, **45**, 397—406).—The viscosity of aqueous solutions of potassium chloride, chlorate, ferrocyanide and ferricyanide, of ammonium iodide, mercuric chloride and cyanide, and of carbamide has been determined for a series of concentrations and temperatures. In regard to the dependence of the relative viscosity on the concentration, the results indicate that the relative viscosity of all solutions passes through at least one minimum, the position of this being determined by the nature of the dissolved substance and the temperature.

For all the solutions examined, with the exception of mercuric cyanide, the relative viscosity increases with rise of temperature. For electrolytes, the rate of increase is very much greater than for non-electrolytes; in this respect, mercuric chloride, which is but slightly ionised, ranges itself with the non-electrolytes.

At low temperatures, aqueous solutions of carbamide exhibit "negative viscosity," and thus furnish an exception to the general rule that this is only exhibited by aqueous solutions of electrolytes.

The effect of the addition of an electrolyte or non-electrolyte to pure water, and, on the other hand, to a solution which has the same viscosity as pure water, is found to be the same if the quantities added are small.

H. M. D.

Viscosity and Conductivity. KURT ARNDT (*Zeitsch. Elektrochem.*, 1907, **13**, 809—812).—The rule which says that the product of maximum equivalent electrolytic conductivity and viscosity is independent of the temperature and of the nature of the solvent is tested for fused sodium metaphosphate and mixtures of it with boron trioxide. Between the melting point and about 900°, the viscosity diminishes very rapidly, whilst the conductivity is a linear function of the temperature; the rule is therefore not even approximately true; above about 900°, however, the viscosity diminishes more slowly, and the rule holds good. It is also shown that above 900° the product of viscosity and equivalent conductivity is constant for mixtures containing from 100% to 0·5% of sodium metaphosphate. If the dissociation of the metaphosphate increases with dilution, the more dilute solutions should be relatively better conductors than the more concentrated ones; since this is not the case, the author draws the conclusion that the salt is completely dissociated even in the pure state at 900°.

T. E.

Spectrophotometry, Viscosimetry, and Electric Signs of Solutions. CHARLES HENRY (*Compt. rend.*, 1907, **145**, 1415—1417).—The results obtained by Mayer, Schaeffer, and Terroine (this vol., ii, 24) on the effect of traces of acids and alkalis on the size of colloidal granules are in agreement with those observed by the author on the effect of traces of chlorine water on solutions or colloidal suspensions of dyes (auramine, crystal-ponceau, or methylene-blue). In the case of the solutions, the molecular aggregates are increased in size, and the viscosity of the solution is diminished, and in the case of the colloidal suspensions the granules are diminished in volume and the viscosity of the solution is increased by the addition of chlorine water. M. A. W.

Permeabilities of Collodion, Gold-beaters' Skin, Parchment Paper, and Porcelain Membranes. S. LAWRENCE BIGELOW (*J. Amer. Chem. Soc.*, 1907, **29**, 1675—1692).—In an earlier paper (Bigelow and Gemberling, Abstr., 1907, ii, 933), the results of experiments on the permeability of collodion membranes under pressures varying from 50 mm. to 250 mm. and at temperatures between 1° and 35° were recorded. Apparatus is now described by means of which determinations have been made through a much greater range of pressure and temperature on the rate of the passage of water through collodion, gold-beaters' skin, parchment paper, and porcelain. The permeabilities of the different membranes are compared. The results show that the rate of passage of water through the molecular interstices of these membranes conforms to the laws regulating the rate of passage of liquids through capillary tubes.

E. G.

Diffusion of Electrolytes in Aqueous Solution. B. LINO VANZETTI (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 696—702. Compare this vol., ii, 20).—Into aqueous solutions of alkali haloid and silver nitrate the author dips the two vertical ends of a horizontal capillary tube filled with water. The length of the tube beneath the surface must be the same for the two solutions, which must stand at the same level and have the same sp. gr. The position at which the silver haloid is deposited in the capillary is then noted. It is found that, in the same time, potassium chloride, bromide, and iodide traverse almost equal paths in the capillary tube. The positions of the layers of precipitate formed can be calculated approximately by assuming that the molecules of both the silver and alkali salts move with velocities equal to the means of the velocities of migration of their respective ions. T. H. P.

Crystal-Systems and Optical Interference-Figures of Liquid Crystals. DANIEL VORLÄNDER (*Zeitsch. physikal. Chem.*, 1907, **61**, 166—170).—Liquid crystals of ethyl azoxybromocinnamate were observed to have the form of tetragonal bipyramids with straight edges. Interference figures in convergent polarised light were seen with liquid crystals of several substances, and are best shown by ethyl anisylideneaminocinnamate. All liquid crystals are optically uniaxial. L. J. S.

Velocity of Crystallisation of Isomorphous Mixtures. MAURICE PADOA (*Atti R. Accad. Lincei*, 1907, [v], 16, ii, 695—696).—Bogojawlenski and Sacharoff's investigations on the velocities of crystallisation of mixtures of isomorphous substances (Abstr., 1907, ii, 751), although extending over a greater range of concentrations than the author's experiments (Abstr., 1904, ii, 390), are in accord with the latter, and hence lead to the conclusions drawn by the author (*loc. cit.*). With some of the substances examined by the author, the maximum velocity of crystallisation was only maintained over a very small temperature interval, whilst in other cases, this maximum could not be attained practically. In these instances, the velocities of crystallisation of the pure substances and of their mixtures were compared at equal degrees of supercooling. This procedure the author defends, as his results were only qualitative. T. H. P.

Solution in a Dissolved Solid. CHARLES L. PARSONS (*J. Physical Chem.*, 1907, 11, 659—680).—The explanation suggested (this vol., ii, 105) for the solubility of glucinum hydroxide in glucinum sulphate is capable of a wider application. The assumption of a complex in cases where the freezing point of a solution of two solutes is abnormally high is not always necessary, for a dissolved solid may itself act as a solvent. Camphor dissolved in aqueous acetic acid raises the freezing point of the latter and lowers its conductivity, and yet no assumption of complexes is made here. So, also, it is possible that iodine dissolves readily in potassium iodide solution, not because a complex is formed, as is generally assumed, but because iodine is soluble in potassium iodide just as iodine is more soluble in aqueous alcohol than it is in water. The author's view is supported by the observation that the iodine and potassium iodide can be partially separated by dialysis, whereas in cases of undoubted complex formation, for example, in potassium silver cyanide solutions, no such separation by dialysis takes place. The dialysis experiments with potassium silver cyanide solutions show that the formation of any other complex than $KAg(CN)_2$ is highly improbable. Further dialysis experiments with boric acid dissolved in borax solutions show that the boric acid is to be regarded as mixed with the borax rather than combined with it as a polyborate; there is no need in this case to assume the existence of complex molecules. J. C. P.

Adsorption and the Behaviour of Casein in Acid Solutions. T. BRAILSFORD ROBERTSON (*J. Biol. Chem.*, 1908, 4, 35—44).—It is questioned whether adsorption or mechanical affinity exists at all, and the theory that proteins form adsorption compounds is considered to be premature and unproved. W. D. H.

Influence of Acids and Bases on the Absorption of Acidic and Basic Dyes by Wool. LOUIS PELET-JOLIVET and N. ANDERSEN (*Compt. rend.*, 1907, 145, 1340—1341).—The authors have determined the amount of crystal-ponceau and methylene-blue absorbed by wool in the presence of varying amounts of hydrochloric, sulphuric, or phosphoric acids, or of sodium hydroxide. The amount of crystal-ponceau absorbed increases with the increasing acidity of the bath, the greatest absorption taking place with hydrochloric acid and the least with phosphoric acid, whilst the amount of methylene-blue absorbed diminishes under the same conditions. In an alkaline bath, almost no crystal-ponceau is absorbed, but methylene-blue shows a maximum absorption.

These results are in accordance with the colloidal theory of dyeing (compare this vol., ii, 18). M. A. W.

Physico-chemical Researches on Lecithin and Cholesterol. Otto Porges and E. Neubauer (*Biochem. Zeitsch.*, 1907, **7**, 152—177. Compare Abstr., 1903, i, 301).—An investigation of the properties of emulsions prepared by adding an ethereal solution of lecithin or an acetone solution of cholesterol to distilled water, and subsequently removing the organic solvent. The suspension of lecithin is homogeneous and stable; it can be filtered, and resembles a colloidal solution; the cholesterol suspension is not very stable by itself, but becomes so in the presence of albumin or of lecithin.

The general conclusion arrived at is, that lecithin is a "hydrophilous" colloid, and cholesterol a "suspension" colloid (these terms are from Höber's "Physikalische Chemie der Zelle und Gewebe." Hydrophilous colloids increase the viscosity of the solvent, and suspension colloids do not. Solutions of the former approximate more closely to true solutions).

In comparing the efficiency of various salts of the alkali metals as lecithin precipitants, the anions and cations are found to be in the same order as that observed by Pauli for the precipitation of albumin (Abstr., 1903, i, 299; 1904, i, 356). Lecithin solutions are peculiar in not being precipitated by concentrated (nor by very dilute) solutions of salts of the alkali metals, but only by solutions the concentration of which lies between certain limits. The precipitation of lecithin by salts of other metals is also, for the most part, closely analogous to the precipitation of albumin (Pauli). With several salts of the heavy metals, the phenomenon is complicated by the occurrence of two precipitation zones, separated by a region of intermediate concentrations in which no precipitation occurs. The precipitation reactions of cholesterol are much more uniform than those of lecithin, and show great similarity to those found by Buxton and Shaffer for mastic suspensions (Abstr., 1906, ii, 839).

Lecithin and cholesterol suspensions are precipitated by acids and dissolved by alkalis, indicating anodic convection. Accordingly, both are precipitated by cathodic colloids at a certain optimal concentration. Cholesterol can, for instance, be precipitated by albumin (at a certain relative concentration and in neutral solution), but not by mastic, which, like cholesterol, is electro-negative. Lecithin and cholesterol form a colloidal compound with each other, since the former protects the latter against precipitation by salts.

The biological application of the results is also discussed. G. B.

Colloidal, Amorphous, and Crystalline States. P. P. von Weimarn (*Chem. Zentr.*, 1907, ii, 1293—1294; from *Zeit. chem. Ind. Kolloide*, 1907, **2**, 76—83).—The observation that the appearance and structure of the precipitate of barium sulphate, obtained by the reaction between manganese sulphate and barium thiocyanate in aqueous solution, depend essentially on the concentrations of both of the participating salts, led the author to extend his researches, with the following results. Equal volumes of normal solutions of different salts, which yield very sparingly soluble precipitates, are mixed at various dilutions, and the precipitates examined macroscopically, microscopically, and ultramicroscopically. Gelatinous precipitates are formed at concentrations so much the smaller the less soluble the precipitate, the more viscous the solutions, and the more complex the reacting substances. Precipitates such as the hydrated oxides of aluminium or silicon are obtained gelatinous on account of their slight solubility; they can be obtained in crystals by a very slow reaction in very dilute solution. Moreover, numerous crystalline substances have been obtained in a gelatinous or quasi-gelatinous state by the addition of substances which lower the solubility (for example, alcohol in the case of the sulphates of calcium, strontium, barium, and lead), or by increasing the concentration (easily applicable with very viscous salt solutions, or with substances the solubility of which does not exceed 10^{-2} per 100 grams of water).

When a proportionality exists between the solubility and the concentration at which a precipitate separates in the gelatinous state, conclusions can be drawn as to the order of magnitude of the solubility of the precipitate, that of aluminium hydroxide being 10^{-8} to 10^{-9} per 100 grams of water at the boiling point, and those of the hydroxides of iron and silicon in water, and of barium sulphate in alcohol, being still smaller.

By continuously increasing the concentrations of the reacting solutions, the average size of the resulting crystals increases from the invisibly minute, through those of ultramicroscopic dimensions (crystalline suspensions, sols), to those of microscopic magnitude; the last reach a maximum (microcrystalline precipitates), and then the size of the crystals, still with solutions of increasing concentration, begins to diminish, until, finally, invisibly minute crystals are again obtained (undifferentiated, transparent jellies).

The crystalline nature of precipitates formed at very small or at very great concentrations cannot be proved optically; nevertheless, the characteristic properties of flocculent and gelatinous precipitates (such as increased solubility and vapour tension, lower melting point, and increased absorptive capacity), as well as their conversion into distinctly microcrystalline precipitates, can be attributed to the properties of crystalline substances in an exceedingly minute state of division.

The author states the following conclusions: (1) the so-called colloidal, amorphous, and crystalline states are general properties of matter; (2) colloidal and amorphous states are modifications of the crystalline. Irreversible sols represent suspensions of very finely-divided, crystalline substances which have lost the power of cohering to form larger aggregates in consequence of the too slight mobility of the crystalline particles and the too great viscosity of the medium. Sols of complex, reversible colloids, such as gluten, are limit cases of true solutions; their coagulation by cooling is identical with the ordinary phenomenon of crystallisation, but the crystals do not attain visible magnitudes because they have lost the power of coherence in consequence of the complexity of the molecule. A gelatinous substance consists of a crystalline, sponge-like framework, which is impregnated with the solution of the substance existing before, or produced by, a reaction. The size of the crystals varies according to the conditions of formation, from the ultramicroscopically invisible to the microscopically visible; so-called amorphous precipitates are crystalline particles of distinctly greater dimensions than those of typical gelatinous substances; (3) the fundamental, and possibly the sole, cause of the formation of amorphous and gelatinous precipitates, as opposed to crystalline, is found in the different conditions of their formation, which is influenced by, or is dependent on, the relative velocity of formation of the substance in the solution, the complexity of the substance, and the viscosity of the medium; (4) in markedly gelatinous media, the velocity of diffusion and of reaction is small, and often practically nil; (5) crystalline structure is conditioned by the internal symmetry of the elementary crystalline particles of substances; this symmetry is not destroyed by the passage into the liquid and gaseous phases. The increase in mobility causes the particles to deviate from directions parallel to their elements of symmetry. The viscosity of very concentrated solutions, or of molten substances near the solidifying point, is caused by the striving of the particles to move parallel to one another, a striving which cannot be fulfilled under the given conditions of temperature and pressure. Identical conditions must hold for the transformation from the liquid to the solid, and from the gaseous to the liquid, states. C. S.

Possibility of Determining the Mass of Suitable Precipitates by Observation of their Rates of Settling. S. KOHN (*Chem. Zeit*, 1907, **31**, 1287).—An attempt to determine the mass of a precipitate by comparing its rate of settling when suspended in a liquid with the rates observed for known masses of the same substance. The method employed is to shake the washed precipitate with a liquid in which it is insoluble in a measuring cylinder, and to observe the times in which the upper surface of the precipitate falls through equal intervals; the results are compared with the rates of settling of two precipitates of known mass, one of greater, the other of less, mass than that to be determined. Details quoted of experiments with barium carbonate and ferric hydroxide show that the rate of settling of a precipitate is only approximately proportional to its mass; hence the error of the method diminishes with the differences between the masses of the three precipitates. The observations for the first two, or even three, intervals must be discarded as abnormal in consequence of the persistence of the movement of the liquid after the mixing. The rates of settling of different precipitates are comparable, of course, only when all the conditions of their precipitation and subsequent treatment are the same. G. Y.

Equilibrium Relations of Chromates in Solution. MILES S. SHERRILL (*J. Amer. Chem. Soc.*, 1907, **29**, 1614—1675).—The conductivity determinations of solutions of chromates, dichromates, and chromic acid carried out by Walden (Abstr., 1888, 1008) indicate that chromic acid exists in solution as H_2CrO_4 dissociating into

$$H^{\cdot} + HCrO_4',$$

or, as Ostwald (Abstr., 1888, 1009) has suggested, as $H_2Cr_2O_7$ dissociating into $2H^{\cdot} + Cr_2O_7''$. The latter view has been generally accepted, whilst the possible existence of the $HCrO_4$ ion has been overlooked. It is pointed out that both of these reactions must be taken into account in studying the constitution of chromic acid solutions. The relative amounts of the $HCrO_4$ and Cr_2O_7 ions present depend on the concentration and the equilibrium constant of the reaction $2HCrO_4' = H_2O + Cr_2O_7''$.

[With F. MALCOLM EATON.]—Cryoscopic determinations have been made with dilute solutions of chromic acid and potassium dichromate. The depression of the f. p. in the most dilute solutions was greater than that which would correspond with complete ionisation into Cr_2O_7 and H or K ions, and the presence of an appreciable quantity of $HCrO_4$ ions was indicated. The values of the equilibrium constant for the second reaction, that is, of the hydration constant,

$$K_{H} = Cr_2O_7''/(HCrO_4')^2,$$

were calculated and found to be 61 from the potassium dichromate and 27 from the chromic acid experiments.

[With ALDEN MERRILL.]—Determinations of the hydrolysis of ammonium chromate in dilute solutions were made by measuring the increase of conductivity produced by the addition of sufficient ammonia to drive back the hydrolysis completely; the value of the ionisation constant, $K_A = H^{\cdot} \times CrO_4'/HCrO_4'$, at 18° was found to be $5{\cdot}7 \times 10^{-7}$.

[With DONALD E. RUSS.]—By means of distribution experiments, the concentration of the ammonia in chloroform was determined which is in equilibrium with the ammonia produced by hydrolysis in dilute ammonium chromate solutions. From the results, the ionisation constant, $K_A = H^{\cdot} \times CrO_4'/HCrO_4'$, was found to be $6{\cdot}2 \times 10^{-7}$ at 18° and $7{\cdot}4 \times 10^{-7}$ at 25°, and is thus about 1/30 of that of acetic acid.

Determinations were made of the solubility of silver chromate in dilute ammonia at 25°, and the value of the solubility product,

$$(Ag^{\cdot})^2 \times CrO_4'',$$

was calculated and found to be 9×10^{-12}, the corresponding silver-ion concentration in the saturated aqueous solution being $2{\cdot}5 \times 10^{-4}$ mols. per litre. Experiments on the solubility of silver chromate in dilute nitric acid showed that, in acid solutions of greater strength than $0{\cdot}075N$, silver chromate is decomposed with separation of silver dichromate as a solid phase. Silver dichromate is decomposed by water or nitric acid solutions of lower concentration than $0{\cdot}06N$ with separation of silver chromate. From these results and the solubility product of silver chromate, the hydration constant, K_{H}, the ionisation constant, K_A, and the solubility product, $K = (Ag^{\cdot})^2 \times Cr_2O_7''$, for silver dichromate were found to be 75, $8{\cdot}4 \times 10^{-7}$, and 2×10^{-7} respectively. This value of the solubility product is equivalent to a concentration of $7{\cdot}3 \times 10^{-3}$ mols. Ag per litre.

The results of this work indicate that in a solution of potassium dichromate containing 0·1 mol. per litre, about 15% of the salt exists as $KHCrO_4$ and 85% as $K_2Cr_2O_7$, whilst in a solution of concentration 0·01 mol. per litre, approximately 45% is present as $KHCrO_4$.

It is shown that the results obtained are in accord with those of Whetham (Abstr., 1903, ii, 405) on the conductivity of potassium dichromate solutions, and of Spitalsky (Abstr., 1907, ii, 695) on the catalytic decomposition of ethyl diazoacetate by chromate solutions, but indicate that Spitalsky's conclusion that dilute solutions of chromic acid and potassium dichromate do not contain any considerable quantity of $HCrO_4$ ions is incorrect. E. G.

Equilibria in Ternary Systems. LUIGI MASCARELLI (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 691—694).—In the case when the freezing-point curve of a binary system does not exhibit a maximum, it may give indications of the formation of an additive product, although no conclusion can be drawn with regard to the proportions in which the two components combine. In general, it is theoretically possible to find a third substance capable of bringing the maximum temperature corresponding with the additive compound below that at which this compound decomposes. This substance should have no action on, and should not be isomorphous with, either of the two components or the additive compound. It is best to employ a third substance of such a nature that the freezing points of the two components are lowered considerably, whilst the eutectic points of the three binary systems formed by the third substance with the two components and the additive compound respectively lie near to the freezing point of the third substance itself. These theoretical considerations are to be tested experimentally. T. H. P.

Hydrolytic Fission of Acetylated Hydroxycarboxylic Acids. JULIUS RATH (*Annalen*, 1907, **358**, 98—125).—Anschütz and Bertram found that the action of water on the acetyl derivatives of lactic and glycollic acids leads to the formation of acetic acid and the hydroxy-acid, the hydrolysis taking place slowly at the ordinary, more quickly at the higher, temperature (Abstr., 1906, i, 966, 990). In continuation of this work, the present author has studied the influence of concentration and temperature on the velocity of the hydrolysis of a number of acetoxy-acids. In each case, the velocity constant does not vary with the time only when calculated according to the equation for unimolecular reactions. This reaction between acetoxycarboxylic acids and water must therefore be intermediate between Ostwald's autocatalysis and true catalysis; although both the original substance and the reaction products act catalytically, the amount of the catalyst, that is of the hydrogen ions which accelerate the hydrolysis, must remain approximately unchanged throughout the reaction. The influence of the concentration on the rate of hydrolysis varies with the acid; in most cases, the velocity increases with the concentration, but in some the rate of hydrolysis is almost unaltered by changes in the concentration, whilst the constant for acetylcitric acid diminishes with increasing concentration. Of the following values for k obtained for the acids named, the first is with $v = 9$, the second with $v = 54$, at 100°, or for acetylcitric acid at 50°.

Acetyl-lactic acid, 0·05011, 0·02548; acetylglycollic acid, 0·06483, 0·04001; diacetyltartaric acid, 0·16149, 0·11128; acetylmalic acid, 0·10467, 0·09209; acetylsalicylic acid, 0·17842, 0·16976; acetylmandelic acid, 0·04423, 0·02548; acetylcitric acid, 0·12414, 0·27512.

The relation of the velocity constant to the temperature is represented by the expression: $\log K = a + bt$; the value $b = 0·02713$ is obtained for diacetyltartaric acid; the temperature-coefficient for intervals of 10° has the normal value 1·87.

Whilst the abnormal behaviour of acetylcitric acid points to a relation between the velocity constant and the constitution of the acetoxy-acid, the data are as yet insufficient to allow of any definite conclusion. G. Y.

Velocities of Catalytic Reactions in Heterogeneous Systems. Decomposition of Hydrogen Peroxide by Means of Platinum Foil Compared with Catalysis by Colloidal Platinum. I. S. TELETOFF (*J. Russ. Phys. Chem. Soc.*, 1907, 39, *Chem.*, 1358—1379).—In order to determine whether Nernst's hypothesis regarding the velocity of reaction in a heterogeneous system is also applicable to catalytic processes (compare Nernst, Abstr., 1904, ii, 315), it is necessary that both the surface of the catalyst and the rate of stirring of the reacting substance should be determined readily. These conditions are fulfilled by the decomposition of hydrogen peroxide by platinised platinum foil. Ordinary platinum foil does not produce decomposition. The thickness of the layer of platinum-black has no influence on the reaction, but in the presence of platinum poisons, such as hydrogen sulphide, carbon disulphide, &c., its activity is destroyed; the activity can be restored by treating the plate with concentrated sulphuric acid at 150—200°. The reaction is unimolecular, and the thickness of the layer surrounding the plate, in this case probably pure water, through which the hydrogen peroxide diffuses, can be calculated from the formula $\delta = D.\ 0^{0·4343}/(0·4343K).v$ (where $\delta =$ thickness of layer, $D =$ the diffusion of hydrogen peroxide in c.c. per minute, $O =$ surface of plate, and $v =$ volume of the solution). For $v = 900$ c.c. and $O = 20$ c.c., $0·4343K = 0·004$ at 25° and 250 revolutions per minute, and thus $\delta = 0·014$ mm., which agrees closely with Brunner's results (Abstr., 1904, ii, 315). Contrary to Henri's statement (Abstr., 1906, ii, 13), calculating δ from Bredig's results, it is found to be 0·065 mm. Towards the end of the reaction, especially in concentrated solutions, K diminishes, owing to the growing passivity of the plate, the activity of which cannot be restored by sulphuric acid; it is probable that an intermediate oxidation product of platinum is formed analogous to the one already isolated for mercury. In acetic acid solution, the reaction is slower, but it is still unimolecular. In sodium hydroxides, it is also unimolecular, and K rises to a maximum in solutions containing 50—100% of the alkali. In this, as in many other respects, the behaviour of the platinum is analogous to that of ferments. Both in the case of the platinum plate and in that of colloidal platinum, K rises 28% for every 10° rise in temperature. In the latter, an ultramicroscopic examination has shown that the velocity of the platinum particles varies in the same degree. In both cases (but especially for colloidal platinum), the velocity of the reaction is largely diminished when the viscosity of the reacting solution is increased by addition of sugar. The following relations for reactions in the presence of a platinum plate are also deduced: $K_1/K_2 = O_1v_2/O_2v_1 = C_1/C_2$ and $K_2 = K_1(n_2/n_1)^{\frac{2}{3}}$ (where $C_1, C_2 =$ the concentration of the catalyst, and n = number of revolutions of the stirrer in the given time). Z. K.

Evolution and Devolution of the Elements. A. C. and A. E. Jessup (*Phil. Mag.*, 1907, [vi], **15**, 21—55).—A theory of evolution of the elements based on astro-physical observations is put forward. According to spectroscopic evidence, matter in the nebulous stage consists of only four elements, two of which are unknown, the third being hydrogen, and the fourth helium. These original elements are termed protons, and are supposed to be formed from primary corpuscles (which at one time represented the only form of matter) by an aggregation into stable integral systems. By a process of condensation of corpuscles round the proton groups, other atoms are supposed to be formed, the various elements representing groupings of maximum stability in a gradual and continuous process.

The authors consider that evolution takes place both along the vertical groups of the periodic table and along the horizontal series. The improbability of the existence of more than four original elements, considered in conjunction with the apparent existence of considerably more groups, leads to the hypothesis that at least one of the protons has given rise to more than one product of evolution. The alkali metal group, the alkaline earth-metal group, and the group of inert elements are supposed to have been evolved respectively from the first (hydrogen), the second (proto-glucinum), and the fourth (helium) protons. From the third proton (proto-boron), the tervalent elements, boron, aluminium, scandium, yttrium, lanthanum, and ytterbium, have been produced by "direct" evolution, and in this case "indirect evolution" has also taken place with the production of quadrivalent carbon. Carbon gives rise directly to silicon and indirectly to nitrogen, oxygen, and fluorine. Silicon, by similar indirect processes, in which hereditary influence plays an important part, is supposed to have given rise to all the elements lying between titanium (atomic weight, 48·1) and arsenic (75). With the exception of manganese, these in turn appear to have given rise to direct evolution products of the same valency. A new form of the periodic table in which these ideas find expression is put forward; this table contains the elements arranged in seventeen vertical groups. For details respecting the relationships expressed by the evolutionary grouping of the elements, the original must be consulted. Mention may here be made of the fact that the incomplete table of elements given by Cuthbertson and Metcalfe (*Phil. Trans.*, 1907, *A*, **207**, 135) from observations on the refractivities of the elements agrees closely with that of the authors.

With regard to the processes of condensation, which result in the formation of assemblages of corpuscles or "rings" around the original proton aggregates, it is supposed that all the principal chemical properties of each element are determined by the structure of the ring, that "direct" evolution along vertical groups corresponds with the addition of similar rings, and "indirect" evolution along horizontal series with the addition of dissimilar or "distorted" rings. Each "ring" is supposed to consist of assemblages of corpuscles in sets of eight, but a certain number of corpuscles (for distinction termed "electrons") are attached in a different manner to the ring system. The number of such differentiated corpuscles determines the valency of an element, and chemical combination is due to the tendency of the electrons to yield sets of eight electrons which in some way constitute electrically neutral systems.

The last two sections of the paper deal with the existence of quantitative relationships between the atomic weights and the possibility of explaining the degradation of the radioactive elements by devolution processes governed by influences similar to those which regulate the evolution of the elements. An outcome of this idea is the view that the α-particles emitted by the various radioactive substances are identical with one or other of the four protons. The values obtained for the masses of the α-particles are not inconsistent with this view.

H. M. D.

Significance of the Atomic Hypothesis. W. A. Kurbatoff (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1181—1216, 1216—1218).—A theoretical discussion of the validity of atomic hypotheses. The relation between the atomicity of the elements and their electrical and heat conductivities and other properties are discussed at length. It is most probable that the metals are all monatomic, whilst most of the other elements are diatomic, and with the exception of sulphur are never more than tetra-atomic; highly complex association only occurring by the union of unlike individuals. Tables are given showing that K/K_1 is a constant approximately for the metals of each group in the periodic system (where K = atomic electrical conductivity at m. p. in absolute temperature, and K_1 = electrical conductivity at 1/2, 1/3, 1/4 this temperature. Thus, for Zn at 692°, $K = 50{\cdot}0$, at 692/2—273 = 73°, $K_1 = 125$, $K/K_1 = 2{\cdot}50$). These constants, as well as similar constants for thermal conductivity and other properties of the metals, also show the usual periodicity in reviewing them from right to left of the periodic table. For the metals, the temperature playing an analogous, but not identical, part with that played by the critical temperature for liquids will probably be the m. p. of the metal at zero pressure, but for practical purposes the m. p. at the ordinary pressure can be taken. A table is given showing that at the temperature 1/3 m. p. (calculated as above), the atomic heat of the elements with but very few exceptions $= 6 \pm 0{\cdot}5$.

Z. K.

Certain Relations between the Atomic Weights of the Elements. Delauney (*Compt. rend.*, 1907, **145**, 1279—1280).—The atomic weights of the elements can be represented with considerable accuracy by ratios of the type A^2/n, where A and n are whole numbers; thus, helium, $2^2/1$; potassium, $14^2/5$; bromine, $39^2/19$, &c. Moreover,

for closely related elements, the divisors (n) are in some instances approximately the same or in regular progression. Thus cadmium, mercury, and zinc have the values $15^2/2$, $20^2/2$, and $14^2/3$, whilst lithium, rubidium, and cæsium have $13^2/24$, $47^2/26$, and $61^2/28$ respectively. In other cases, however, related elements have widely different divisors, whilst unrelated elements have similar ones. These anomalies can, however, be eliminated if the more general ratio $(Aa)^2/na^2$, where a is a whole number, be employed. Thus the value for potassium ($14^2/5$) can be made comparable with that of sodium ($22^2/21$) by taking $a=2$, when the former value becomes $28^2/20$. The divisors for a family of elements often fall into a regular series; thus for boron, scandium, yttrium, lanthanum, and aluminium the atomic weights are represented by $11^2/11$, $23^2/12$, $34^2/13$, $50^2/18$, and $25^2/23$.
E. H.

The so-called Physico-chemical Atomic Weights and the Calculation of the Weight of a Normal Litre of Gases. Gustav D. Hinrichs (*Chem. Zentr.*, 1907, ii, 1290; from *Mon. sci.*, 1907, [iv], **21**, II, 581—583. Compare Abstr., 1893, ii, 316, 317; 1906, ii, 197).—The author denies the possibility of obtaining accurate atomic weights by weighing gases, because the so-called physico-chemical methods only confirm the gravimetric methods which he has shown to be false, and depend on gas theories, in particular, that of van der Waals.

The weight of a normal litre can be calculated by multiplying the absolute atomic weight by 44·655 mg. The discrepancy in the cases of hydrogen and carbon dioxide between the calculated values and those found experimentally by Leduc and by Rayleigh indicates that the molecular volumes of these gases are only 0·9936 of those of oxygen, nitrogen, and carbon monoxide.
C. S.

Are the Stoichiometric Laws Intelligible without the Atomic Hypothesis? Otto Kuhn (*Chem. Zeit.*, 1908, **32**, 55—56. Compare Abstr., 1907, ii, 678).—A further adverse criticism of Wald's attempt to establish the stoichiometric laws without the aid of the atomic hypothesis (*Chem. Zeit.*, 1906, **30**, 963, 978; Abstr., 1907, ii, 755).
G. Y.

The Metallic Form of Metalloids. Eduard Jordis (*Zeitsch. angew. Chem.*, 1907, **20**, 2241—2245.)—In the periodic system, the metals lie to the left and foot, the metalloids to the right and top, of the table. Between these are certain intermediate elements, such as arsenic and antimony, which may be obtained in both the metallic and the non-metallic states. Others besides the typical intermediate elements might be expected under favourable conditions to change their state. Of the nine non-metals, nitrogen and phosphorus occur as metals in alloys, whilst oxygen, sulphur, and probably iodine exhibit metallic properties in certain oxides, sulphides, and iodides, especially in regard to their optical, thermal, and electrical behaviour; hydrogen unites directly with metals, and forms the cation $H^{\cdot}$.

The metallic state is therefore a more common property of the elements than is generally supposed, and it may be expected that under suitable conditions this state will be assumed by the remaining non-metals, chlorine, bromine, and fluorine, with greatest difficulty probably in the case of the last. The converse change, that of the metals into the metalloid state, is considered to take place less frequently, or in other manners. The passivity of the metals, the cathodic and anodic phenomena, and the properties of minerals and compounds of metals with metalloids are discussed from this point of view. G. Y.

Modification of Kundt's Method of Producing Dust-Figures by Stationary Waves, and a New Determination of C_p/C_v for Helium. Ulrich Behn and H. Geiger (*Ber. deut. physikal. Ges.*, 1907, **5**, 657—666).—The time of vibration of a closed tube can be altered very simply by loading the ends of the tube; this is effected by cementing discs of metal symmetrically on to the two ends by means of sealing-wax. By taking the requisite number of such discs, the pitch of the vibrating tube may be made to correspond with an exact multiple of half wave-lengths in the enclosed gas, and stationary waves are then set up, giving rise to corresponding dust-figures.

The wave-lengths in helium and air have been compared by this method, and from the results the value of C_p/C_v for helium is found to be 1·63, indicating that the gas is monatomic. H. M. D.

A New Vacuum Regulator. K. W. Holterman (*Chem. Zeit.*, 1908, **32**, 8).—The author describes and figures a vacuum regulator consisting of nine glass manometer tubes connected in series between the vacuum distillation apparatus and a bottle communicating with the outer air by a tube drawn to a fine point. The manometer tubes are charged with an amount of water such that air is drawn through the regulator when the pressure in the distillation apparatus falls below that desired. Variations in the atmospheric pressure are compensated by means of a tenth manometer tube arranged to rotate on its horizontal axis. G. Y.

Porous Materials as Substitutes for Stopcocks in the Manipulation of Gases. Alfred Stock (*Ber.*, 1907, **40**, 4956—4959. Compare Prytz, *Ann. Physik*, 1905, [iv], **18**, 617).—Prytz's porous material is replaced by a material made by burning a mixture of earthenware, water glass, and gum. Plates of considerable homogeneity are thus produced, they are not affected by dilute acids or boiling water, and can readily be fused into glass vessels. Their porosity is indicated by the following numbers: a plate of 8 mm. diameter and 2—3 mm. thickness allows 600—800 c.c. of air to pass per minute with a difference in pressure of 60 cm. of mercury. The plates do not admit of the passage of mercury, even with a difference in pressure of 1 atmosphere. The plates can be fused into the ends or middle of tubes, and used in much the same manner as suggested by Prytz. A more complex apparatus is described containing two porous plates and an ordinary cock surrounded by mercury. J. J. S.

Inorganic Chemistry.

Atomic Weight of Hydrogen. William A. Noyes (*J. Amer. Chem. Soc.*, 1907, **29**, 1718—1739).—In earlier papers (Abstr., 1889, 672; 1890, 1370), determinations of the composition of water have been recorded which indicated that the atomic weight of oxygen is probably slightly less than 15·896. At the close of each of these experiments, a small amount of gas was obtained which was assumed to be nitrogen; the weight of this gas, calculated as nitrogen, was subtracted from the weight of hydrogen, giving a correction of about 1 part per 1000. Later, after the appearance of Morley's papers (Abstr., 1895, ii, 261; 1896, ii, 640), it was considered likely that this gas came from the copper oxide and that its weight should be deducted from the weight of the oxygen instead of from that of the hydrogen. On applying this correction, the value 15·879 (or H = 1·00765) was obtained, which coincides with Morley's result. Further experiments are now described which have been carried out with the object of testing this explanation of the earlier results.

The apparatus employed was similar to that used in the previous work, and special precautions were taken to ensure the purity of the hydrogen and to avoid leakage. The weight of the hydrogen was determined by the increase in weight of a piece of apparatus containing copper oxide, and in which the water formed by the oxidation of the hydrogen was condensed.

The first experiments were vitiated by the retention of water by the copper oxide, and were therefore rejected. In subsequent experiments, efforts were made to reduce this source of error as far as possible.

In the second series, the hydrogen was obtained by the electrolysis of dilute sulphuric acid, and was weighed first in palladium, and again after being transferred to the copper oxide tube. The mean result of seven determinations gave H = 1·00788 ± 0·00002.

In the third series, the hydrogen, obtained by the electrolysis of dilute sulphuric acid, was led directly into the copper oxide tube and converted into water. The mean of five experiments gave H = 1·00771 ± 0·00004.

In the fourth series, the use of copper oxide was avoided by absorbing the hydrogen in palladium and converting it into water by means of oxygen, both gases being obtained by the electrolysis of dilute sulphuric acid. The mean of eight determinations gave H = 1·00812 ± 0·00003.

In the fifth series, hydrogen and oxygen, obtained by the electrolysis of barium hydroxide solution, were combined by means of palladium. The mean of five experiments gave H = 1·00787 ± 0·00002.

The most probable value for the atomic weight of hydrogen which can be calculated from these results is 1·00787. For certain reasons, however, it is considered that a more trustworthy value is a mean between this and Morley's value (1·00762 ± 0·00002), namely, 1·00775, During the course of the work, evidence was sought with regard to the question as to whether change of weight occurs in a chemical reaction in which a large amount of energy is dissipated. Conclusive evidence was not obtained, but it was found that if any change of weight takes place, it must be very small. E. G.

Formation of Ozone by the Action of the Electric Discharge at Low Temperatures. E. BRINER and E. DURAND (*Compt. rend.*, 1907, **145**, 1272—1274. Compare Abstr., 1907, ii, 759; Hautefeuille and Chappuis, Abstr., 1880, 847; Olszewski, Abstr., 1887, 634; Beill, Abstr., 1893, ii, 317; Troost, Abstr., 1898, ii, 569; Ladenburg, Abstr., 1899, ii, 18; Goldstein, Abstr., 1903, ii, 723).—By means of the apparatus described previously (Abstr., 1907, ii, 342), in which the sparking-bulb is replaced by the ordinary double-walled ozoniser, the authors have studied the action of the silent discharge on oxygen at low temperatures. When the ozoniser is cooled in a mixture of solid carbon dioxide and ether (−78°), a limiting concentration of 11% of ozone is obtained, which is the same as that observed by Beill, and is characteristic of this temperature. At −78°, 12 grams of ozone are formed per kilowatt-hour. By immersing the ozoniser in liquid air (−194°), the vapour tension of ozone is reduced nearly to zero, and it becomes possible to change oxygen almost completely (99%) into ozone. As the mean pressure is reduced from 203 mm. to 27 mm., the yield of ozone per kilowatt-hour rises to a maximum of 55 grams at 98 mm. and then falls. The ozone as it is formed condenses to a deep blue, viscous liquid. The optimum pressure of about 100 mm. is the same as that observed in sparking mixtures of nitrogen with oxygen and hydrogen, and in the formation of oxides of nitrogen by the electric arc (Haber and Koenig, this vol., ii, 34). The action of the electric spark on oxygen cooled to −194° produces ozone to the extent of only 0·79%, and this is probably due to the silent discharge accompanying the spark. E. H.

Acid Properties of Ozone. WILHELM MANCHOT and W. KAMPSCHULTE (*Ber.*, 1907, **40**, 4984—4990).—When ozone is passed into liquid ammonia which is strongly cooled, a deep orange-red colour is obtained; this vanishes, whilst the ammonia is still liquid when the temperature is raised. When the coloured liquid is introduced into cooled titanium sulphuric acid, hydrogen peroxide can be detected, and this is also the case with the colourless liquid.

Ozone forms a thick fog with ammonia at the ordinary temperature, whereby nitrite is not formed. A similar fog is given by other organic bases, and is the more intense the stronger the base. The ozone compounds of the alkali metals described by Baeyer and Villiger (Abstr., 1902, ii, 650), obtained by the action of ozone on their hydroxides, when orange-brown or yellow substances are formed, give intense colorations when introduced into strongly cooled titanium sulphuric acid, except in the case of sodium hydroxide. Cæsium gives the most, lithium the least, stable ozone compound. When heated in a stream of 8—9% ozone, the sodium compound is decolorised at about 90°, the potassium at about 110° and the rubidium at about 140°; the colour given by cæsium hydroxide remains to above 160°. Lithium hydroxide gives no coloration with ozone, and must decompose below the ordinary temperature. The hydroxides of magnesium, calcium, strontium and barium decompose ozone very rapidly at the ordinary temperature; at lower temperatures, barium oxide shows a distinct coloration, that of calcium oxide is less marked, and magnesium oxide gives no colour. These metals behave therefore analogously to the alkali metals.

The oxygen-carrying power of the alkaline earths previously observed in the case of the action of ozone on metallic silver (Abstr., 1907, ii, 616) may, in view of the above, be explained as due to calcium hydroxide combining with ozone and giving up oxygen to the silver.

The formation of these compounds is attended by a considerable development of heat. They are decomposed by water, and ozone may be passed through 50% sodium hydroxide almost without decomposition until a temperature of 70° is reached. Additional proof of the acid properties of ozone is afforded by the following observations. Strong ozone above 6%, fumes in moist air; blue litmus paper is rendered faintly red, and other indicators show an unmistakable acid reaction. Ozone passed into water increases the conductivity; this appears to be due, in part, to a decomposition product, since the water remains a conductor when ozone is no longer to be detected.

E. F. A.

Persulphides of Hydrogen. Giuseppe Bruni and Alessandro Borgo (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 745—754).—The authors have prepared a number of persulphides of hydrogen, and find that the proportion of sulphur added to the alkali sulphide or the composition of the alkali polysulphide employed has no influence on the composition of the hydrogen persulphide obtained. Cryoscopic examination of the various products dissolved in bromoform indicates the probable existence in solution of compounds varying from H_2S_5 to H_2S_9.

T. H. P.

Acid Energy of Thiosulphuric Acid and the Decomposition of this Acid. Joseph A. Muller (*Bull. Soc. chim.*, 1907, [iv], **1**, 1155—1158. Compare Berthelot, Abstr., 1889, 824).—Measurements of the amounts of heat absorbed when (*a*) 1 gram-molecule of hydrochloric acid and (*b*) 2 gram-molecules of hydrochloric acid are added to 1 gram-molecule of sodium thiosulphate, show that the absorption of heat, due to the formation of $NaHS_2O_3$ in the first reaction, approximates to that due to the formation of $Na_2S_2O_3$, from $NaHS_2O_3$ first formed, in the second, when the reactions are conducted at such dilutions that the changes due to secondary reactions become negligible. Consequently, the "acid energies" of the two hydrogen atoms in thiosulphuric acid are approximately equal.

As illustrating the instability of thiosulphuric acid, it is mentioned that on the addition at 12° of a gram-molecule of hydrochloric acid, dissolved in 16 litres of water, to a gram-molecule of sodium thiosulphate, dissolved in a similar quantity of water, sulphur begins to be deposited after 1·5 minutes, and the reaction continues until one atom of the sulphur is liberated. When 2 gram-molecules of hydrochloric acid are employed in the place of 1 gram-molecule in such an experiment, the precipitation of the sulphur is never complete, indicating that, whilst the sodium hydrogen thiosulphate formed in the first case decomposes completely into sodium hydrogen sulphite and sulphur, the thiosulphuric acid liberated in the second case is only partially decomposed, yielding sulphurous acid and sulphur.

T. A. H.

Effect of Heating Yellow Phosphorus in Ammonia Gas. William G. Llewellyn (*Chem. News*, 1907, **96**, 296—297).—Neither yellow nor red phosphorus reacts with ammonia gas between 10° and 100°; white phosphorus is obtained by distilling yellow phosphorus in an atmosphere of ammonia. W. H. G.

Carbon Suboxide. III. Otto Diels and Paul Blumberg (*Ber.*, 1908, **41**, 82—86. Compare Abstr., 1906, ii, 227; 1907, ii, 180).—An attempt to solve the problem of the constitution of carbon suboxide has been made by an examination of its molecular refraction and dispersion. The actual values obtained, mol. ref. 16·6 and mol. dis. 0·736, 0·739, and 0·862, are more in harmony with Diel's formula CO:C:CO, calculated values $M_D = 15·49$ and $\gamma - \alpha = 0·749$, than with Michael's (Abstr., 1906, ii, 442), for which the values $M_D = 13·57$ and $\gamma - \alpha$ 0·435 have been calculated.

The fact that the values actually obtained are somewhat higher than those calculated for Diel's formula points to an "exaltation" due to the numerous double bonds in the system O:C:O:C:O.

According to Brühl (Trans., 1907, **91**, 115), contiguous double bonds produce a measurable exaltation of the molecular refraction and dispersion, whereas compounds with "cumulative" double bonds are optically normal. J. J. S.

Silicates. VII. Eduard Jordis (*Zeitsch. anorg. Chem.*, 1907, **56**, 296—319. Compare Abstr., 1903, ii, 475, 542, 595; 1905, ii, 88, 248).—The preparation of crystalline sodium metasilicate is described, and some of the properties of aqueous solutions of alkali silicates are discussed.

In aqueous solution, sodium hydroxide retains silica in the proportion $2·5—2·7SiO_2 : 1Na_2O$. Fused sodium hydroxide dissolves more silicic acid than does the aqueous solution, so that the fused mass is partially decomposed by water. Concentrated solutions of sodium silicate gelatinise on cooling and become liquid again on warming.

Crystallised sodium metasilicate, Na_2SiO_3, with 6 and 10 H_2O, has been obtained by crystallisation from a solution containing 3 mols. of sodium hydroxide to 1 mol. of silica. It is purified by recrystallisation from *N*-sodium hydroxide, and washing with 50% alcohol. The metasilicate dissolves in water, forming a solution of definite and reproducible properties.

Attempts to prepare sodium orthosilicate, sodium hydrogen metasilicate, or potassium metasilicate in crystalline form in the wet way have so far proved unsuccessful.

Solutions of pure sodium silicate are not precipitated by ammonia or by electrolytes, but solutions of "water glass" yield precipitates under these conditions. The precipitate which separates from solutions of alkali silicates after a time consists mainly of impurities (aluminium and iron). G. S.

Rubidium Calcium Sulphates. JOH. D'ANS and W. ZEH (*Ber.*, 1907, **40**, 4912—4914. Compare Abstr., 1907, ii, 168).—A study of the double sulphates of rubidium and calcium has resulted in the isolation of two new salts, although Ditte's double salt,

$$Ca_2Rb_2(SO_4)_3,3H_2O,$$

could not be prepared (Abstr., 1877, i, 440).

Rubidium syngenite, $CaRb_2(SO_4)_2,H_2O$, prepared by leaving finely-divided gypsum in contact with a 30% solution of rubidium sulphate, crystallises in strongly refracting needles, probably isomorphous with the potassium and ammonium syngenites. On boiling calcium sulphate with 30% aqueous rubidium sulphate, *rubidium dicalcium sulphate*, $Ca_2Rb_2(SO_4)_3$, is formed; its crystalline form is similar to that of the corresponding ammonium salt. The rubidium syngenite is converted into the dicalcium salt in contact with aqueous rubidium sulphate at 40°. Attempts to prepare the pentasulphate have, so far, been unsuccessful.

In the series potassium, ammonium, rubidium, the stability of the dicalcium salt increases, whilst that of the pentasulphate decreases. W. R.

Action of Ammonium Persulphate on Metals. J. W. TURRENTINE (*J. Physical Chem.*, 1907, **11**, 623—631).—When a strip of copper is immersed in ammonium persulphate solution, it loses in weight, and the loss in weight is very nearly the equivalent of the reduced persulphate. Copper, immersed in ammonium persulphate, behaves therefore like a copper anode in the electrolysis of sulphates. This analogy between chemical corrosion in ammonium persulphate and electrolytic corrosion in ammonium sulphate is borne out also by the behaviour of nickel, cadmium, and aluminium. In the case of nickel, the loss of weight is about 13% less than the equivalent of the reduced persulphate. Cadmium dissolves readily in ammonium persulphate without evolution of gas, but there is considerable discrepancy between the observed and calculated values for the loss of weight. Only slight corrosion of aluminium occurs in ammonium persulphate solution. Ammonium persulphate dissolves iron, forming ferrous sulphate, some of which is oxidised by the excess of the persulphate. It appears that the free acid formed by the hydrolysis of ferric sulphate acts as a catalytic agent in the reaction between iron and water. J. C. P.

Action of Silver Nitrate and of Mercuric Nitrate on some Inorganic Hydroxides. WILHELM BILTZ and FRIEDRICH ZIMMERMANN (*Ber.*, 1907, **40**, 4979—4984).—When freshly-precipitated magnesium hydroxide is moistened with a solution of silver nitrate, the hydrogel is coloured yellowish-brown, owing to the separation of silver oxide. The authors have studied the behaviour of other inorganic hydroxides towards both silver nitrate and mercuric nitrate. The various hydroxides were precipitated by ammonia from the hot solutions of their salts, washed until free from ammonia, and then saturated with *N*/10 silver nitrate. Glucinum, aluminium, indium, zirconium, stannic, antimony, and bismuth hydroxides respectively gave no reaction, zinc hydroxide was coloured faintly brown, cadmium hydroxide strongly brownish-yellow, and lead hydroxide somewhat violet-brown. With mercuric nitrate, the hydroxides of indium, zirconium, antimony, and bismuth gave no reaction, glucinum hydroxide was coloured yellowish-red, magnesium hydroxide strongly yellowish-red, zinc hydroxide faintly yellow, cadmium hydroxide strongly yellowish-red, aluminium hydroxide faintly yellow, lead hydroxide yellowish-red, and bismuth hydroxide brightly yellow. The behaviour of a number of hydroxides of rare elements was studied from the same standpoint. A. McK.

Solubility of Calcium Carbonate in Aqueous Solutions of Potassium Chloride and Potassium Sulphate at 25°. Frank K. Cameron and William O. Robinson (*J. Physical Chem.*, 1907, **11**, 577—580. Compare Abstr., 1902, ii, 320).—Calcium carbonate is much more soluble in aqueous solutions of potassium sulphate than in aqueous solutions of potassium chloride. The solubility curve for calcium carbonate in the chloride solutions passes through a maximum. When calcium carbonate is kept in contact with potassium sulphate solutions containing more than 2·98% K_2SO_4, syngenite is formed. J. C. P.

Soluble Basic Sulphates of Glucinum. Charles L. Parsons, William O. Robinson, and C. T. Fuller (*J. Physical Chem.*, 1907, **11**, 651—658).—A solution of glucinum sulphate dissolves fairly large quantities of glucinum hydroxide, and the solutions obtained in this way have been examined by the authors. It is shown that the addition of glucinum hydroxide to a solution of glucinum sulphate raises the freezing point of the latter and lowers its conductivity. The solutions obtained are not true colloids, as shown by dialysis experiments, nor does the glucinum enter into a complex anion. It is suggested that the dissolved glucinum salt acts as a solvent for the hydroxide, just as acetic acid dissolved in water will dissolve camphor, which is itself insoluble in water. J. C. P.

Alloys of Zinc and Nickel. Victor Tafel (*Metallurgie*, 1907, **4**, 781—785).—Alloys containing up to 50% of nickel were prepared by adding nickel to molten zinc covered with a layer of borax. The freezing-point curve has a eutectic point very close to the zinc end, the eutectic temperature being only 0·5° below the melting point of zinc. Eight different crystalline constituents were observed. I is pure zinc; the series of mixed crystals II contain from 12·2% to 23% of nickel; III is the compound $NiZn_3$, indicated by a maximum on the freezing-point curve; the mixed crystals IV contain from 39·7% to 45·8% of nickel, and break up on cooling to 640° into the crystals V and VI. Crystals VII separate from the molten mass, but then react with it at 1025—1037° to form IV. The mixed crystals VIII are formed when alloys containing more than 45·8% of nickel are cooled to 780°. The exact nature of the crystals, with the exception of the compound $NiZn_3$, could not be determined.

The brittleness of zinc is greatly increased by the addition of nickel; $NiZn_3$ is extremely brittle, and gives a characteristic blue coloration with dilute nitric acid. Photo-micrographs of the alloys are given.

C. H. D.

New Kind of Dioxides. I. LUIGI MARINO (*Zeitsch. anorg. Chem.*, 1907, **56**, 233—245).—It is shown that the dioxides of manganese, lead, and barium react quite differently towards sulphur dioxide, and it is therefore suggested that the constitution of the three dioxides must be different.

Pure manganese dioxide was suspended in water, and sulphur dioxide passed in at 10—12° until a clear solution was obtained. Analysis showed that the solution thus obtained contained manganese dithionate and a little sulphate; the main reaction is therefore represented by the equation $MnO_2 + 2SO_2 = MnS_2O_6$. At the same time, the "induced" reaction $MnS_2O_6 + MnO_2 = 2MnSO_4$ takes place to a slight extent.

By the action of sulphur dioxide on lead peroxide, on the other hand, a heavy, white powder consisting of a mixture of lead sulphate and sulphite was obtained, and not a trace of dithionate was formed. Evidence is adduced to show that the successive stages of the reaction are as follows: $PbO_2 + SO_2 = PbSO_3 + O$; $SO_2 + O + H_2O = H_2SO_4$; $PbSO_3 + H_2SO_4 = PbSO_4 + H_2SO_3$.

When barium peroxide is used, the first stage of the reaction is represented by the equation $BaO_2 + H_2SO_3 = BaSO_3 + H_2O_2$, the hydrogen peroxide then oxidising the sulphur dioxide and barium sulphite to sulphuric acid and barium sulphate respectively.

Selenious acid also behaves differently towards the peroxides of lead and manganese; the results of the investigation will be communicated later.

The difference in behaviour of the dioxides in question is ascribed to a difference of constitution, which for those of manganese and lead may be represented by the constitutional formulæ $\mathrm{Mn}{\ll}\begin{smallmatrix}\mathrm{O}\\ \mathrm{O}\end{smallmatrix}$ and $\mathrm{Pb}{\lll}\begin{smallmatrix}\mathrm{O}\\ |\\ \mathrm{O}\end{smallmatrix}$. As the sesquioxides of iron and cobalt give, like manganese dioxide, additive compounds with sulphur dioxide (Seubert and Elten, Abstr., 1893, ii, 278), they may also contain a group of the type $\mathrm{M}{\ll}\begin{smallmatrix}\mathrm{O}\\ \mathrm{O}\end{smallmatrix}$; the formula for ferric oxide would therefore be $\mathrm{O{:}Fe{:}Fe}{\ll}\begin{smallmatrix}\mathrm{O}\\ \mathrm{O}\end{smallmatrix}$.

The constitutional formula of dithionic acid is also discussed.

G. S.

Action of Oxygen on Copper, Tin, Zinc, and the Alloys of Tin and Zinc with Copper. Eduard Jordis [with W. Rosenhaupt] (*Chem. Zeit.*, 1908, **32**, 19—21. Compare Jordis, this vol., ii, 98).—The rate of absorption of dry, and of moist, oxygen by copper, tin, zinc, and alloys of tin and zinc with copper has been determined at various temperatures and the results expressed in curves. The reaction commences with copper at about 80°, with tin above 100°, and with zinc at 150°; at temperatures below 200°, the dry oxygen is absorbed slightly the more rapidly by copper and tin, the moist oxygen by zinc, but above 200°, whilst the relation between the rates of absorption by tin remains approximately unchanged, the moist oxygen is absorbed much more rapidly than the dry gas by copper and zinc. An alloy containing 70% of copper and 30% of tin acts as a mixture of the compound Cu_3Sn with an excess of copper, and the alloys of copper and zinc as mixtures of Cu_2Zn with an excess of copper or of zinc. The absorption curves of the alloys resemble to some extent those of the metal present in excess. The discussion of the results leads to the conclusion that the oxidation of these metals and alloys is not a simple process, but consists of several simultaneous reactions, one of which must be a diffusion of the oxygen in the metallic state through the metal or alloy. G. Y.

Action of Lime in Excess on Copper Sulphate Solutions. James M. Bell and Walter C. Taber (*J. Physical Chem.*, 1907, **11**, 632—636).—The authors have determined the composition of the solution and of the precipitates obtained when lime and copper sulphate solutions are mixed in different proportions and concentrations. The results are summarised in the following table:

Gram per litre.		
CaO.	SO_3.	Solid phases.
1·206	0·0	$Ca(OH)_2$, blue copper hydroxide.
1·780	0·872	$Ca(OH)_2$, blue copper hydroxide.
1·908	1·060	$Ca(OH)_2,CaSO_4,2H_2O$, blue copper hydroxide.
1·888	1·052	$CaSO_4,2H_2O$, blue copper hydroxide.
1·358	1·112	$CaSO_4,2H_2O$, blue copper hydroxide.
1·120	1·144	$CaSO_4,2H_2O$, green copper hydroxide.
0·880	1·280	$CaSO_4,2H_2O$, green copper hydroxide.

In the preparation of Bordeaux mixture, a very large excess of lime is added, and the precipitate will consist of the three solids, lime, gypsum, and the blue copper hydroxide. J. C. P.

Solubility of Gypsum in Copper Sulphate Solutions. James M. Bell and Walter C. Taber (*J. Physical Chem.*, 1907, **11**, 637—638).—The solubility of gypsum at first diminishes as the concentration of copper sulphate increases, until at a copper sulphate concentration of 30 grams per litre the solubility of gypsum reaches a minimum of 1·7 grams $CaSO_4$ per litre. Further increase in the copper sulphate concentration causes a rise in the solubility (at first rapid and then slow), and a solution which is saturated with copper sulphate dissolves gypsum to the extent of 2·08 grams per litre. J. C. P.

The Nature of the Phosphorescent Elements and Meta-elements of Sir W. Crookes. GEORGES URBAIN (*Compt. rend.*, 1907, **145**, 1335—1337).—The phosphorescent spectra afforded by mixtures in varying proportions of the anhydrous sulphates of pure gadolinium and terbium contain the bands which were attributed by Sir W. Crookes to the elements or meta-elements G_α, G_ζ, G_β, ionium, and incognitum (Abstr., 1887, 334; 1906, ii, 62). The intensity of the bands varies with the composition of the mixture, and the mixtures containing less than 0·5% or more than 10% of terbium are very slightly phosphorescent. The author concludes that in these mixtures the terbium, which is the active phosphorescent substance, is not a mixture of several elements.
M. A. W.

Bayer's Bauxium. G. GRINER and GEORGES URBAIN (*Bull. Soc. chim.*, 1907, [iv], **1**, 1158—1163).—In manufacturing alumina from the red bauxite of Var, the sodium aluminate obtained by roasting the mineral with sodium carbonate is decomposed by a current of carbon dioxide, and the sodium carbonate is recovered from the filtrate by evaporation. The mother liquors from the last process contain chromic, vanadic, molybdic, tungstic, phosphoric, arsenic, and silicic acids with small quantities of alumina, magnesia, lime, &c., and after the removal of these various constituents Bayer obtained (Abstr., 1895, ii, 313) a violet-coloured solution, which on exposure to air became yellow and gave other reactions which led him to suppose that it contained a new element "bauxium."

This material has now been examined spectrographically by the authors, and they find that it consists essentially of a mixture of vanadium and tungsten containing a trace of molybdenum and minute traces of copper, bismuth, lead, calcium, and sodium, and that a dilute solution of ammonium vanadate containing a small quantity of ammonium tungstate gives all the reactions which Bayer thought to be characteristic of bauxium.

Bayer's misapprehension of the nature of the solution he obtained appears to have been due to his supposition that vanadium can be completely removed from solution as ammonium vanadate and tungsten as tungstic acid, which it appears now is not the case.

A detailed description of the spectrographic method employed by the authors is given in the original. T. A. H.

Gases Occluded in Steels. G. BELLOC (*Compt. rend.*, 1907, **145**, 1280—1283. Compare Abstr., 1903, ii, 484).—The work described refers to (1) the nature of the gases; (2) the form of the curves in t and dv/dt relatively to the total volume and to the volume of each gas; (3) the relative proportions of each gas at different temperatures; (4) the relations of these curves to the critical points; (5) variation of the gases according to the thickness of the section of metal from which they are derived, and (6) their alteration with different steels. Two bars of a very soft steel containing 0·12% of carbon, 0·03% of silicon, 0·02% of sulphur, 0·018% of phosphorus, and 0·35% of molybdenum, chosen so that its critical points are well separated, were examined. Their critical points were carefully determined by Roberts-Austen's differential method. The evolution of gases is in intimate relation with the critical points of the iron, and may be divided into three stages. (1) The evolution begins at a variable and ill-defined temperature (150°—400°); the *dv/dt* curve has a small minimum at 200° and a small maximum at 300°, but the evolution is small below the point A_o. (2) Between 500° and 600° the *dv/dt* curve exhibits a large maximum at the point A_n, and then falls rapidly to a minimum (approaching zero) at the end of A_2. The point A_1 has no well-defined influence in the steel considered. (3) The evolution increases again at the beginning of A_3, then diminishes slowly, and seems to increase afresh with the temperature. Adopting Osmond's definition of the point A_o, these stages can be interpreted thus: (1) In the region of the α-iron, the evolution of gas is very small, and apart from small irregularities tends to increase with the temperature. (2) The commencement of the conversion of α-iron into β-iron is characterised by an abundant evolution which diminishes as the conversion progresses. The transformation of the cementation carbon into "temper" carbon to the extent of 0·12% has no marked influence. (3) The evolution recommences with the transformation of the β-iron into γ-iron, and after passing through a maximum seems to increase with the temperature in the region of the γ-iron.

The gases evolved consist of carbon monoxide and dioxide, hydrogen and nitrogen. The first produced is carbon dioxide, which at the beginning forms almost the total volume. It disappears at about 550° (A_o). Nitrogen begins to appear at about 550°, and persists at all higher temperatures, but the amount is small, not rising above a mean value of 10%. Above 400°, hydrogen and carbon monoxide alone are evolved, but their proportions are subject to sudden alteration with the temperature. A larger volume of gas was evolved, and the evolution commenced sooner from the first bar than from the second, probably owing to initial loss of gas from the latter by its finer subdivision. The gases are very irregularly distributed in the steel, the proportion in the intermediate layers being much greater than in the superficial and central portions. As regards the state of the gas in the metal, observations made are not in favour of the existence of a dissociation-tension. E. H.

Extraction of Gases Contained in Metals. Octave Boudouard (*Compt. rend.*, 1907, **145**, 1283—1284).—The author has heated in a vacuum, commercial iron in the form of bars 1 square cm. in cross-section, sheet 1 mm. thick, wire 2 mm., 1 mm., and 0·5 mm. in diameter, and of filings. Wire 1 mm. thick when heated at the temperature of boiling sulphur (445°) does not evolve gas, but under the same conditions 31·5 grams of filings evolve 6·45 c.c. of gas, chiefly carbon monoxide and hydrogen. The results of heating the iron in its various forms at 1100° in a vacuum three times, allowing fifteen days' exposure to the air between the consecutive ignitions, are given in tabular form. They show that it is extremely difficult to extract the gases contained in iron and steel. The metal after a third ignition at 1100° retains an appreciable volume of gas, varying according to its state of division (from 0·5% of total volume extracted in the case of filings to 20% with sheet- or bar-iron). A table is given containing the total percentage volumes and weights of carbon monoxide, hydrogen, carbon dioxide, and nitrogen expelled by three ignitions at 1100° of wire 0·5 and 1 mm. thick, sheet 1 mm. thick, and filings. The total percentage weights of gas evolved are 0·0957%, 0·1029%, 0·099%, and 0·2207% respectively, these quantities being of the same order as the amounts of sulphur and phosphorus ordinarily present.

The values obtained for nitrogen are of the same order as those observed by Braune (Abstr., 1905, ii, 638 ; *Rev. de Métallurgie*, 1907, **2**, 834). In a vacuum, iron begins to volatilise at 900°, and does so very appreciably at 1100°. E. H.

Solubility of Graphite in Iron. Georges Charpy (*Compt. rend.*, 1907, **145**, 1277—1279. Compare Abstr., 1902, ii, 209).—The determination of the solubility of graphite in iron is rendered very difficult by the exceeding slowness of the dissolution of graphite, or the conversion of the combined carbon into graphite, which necessitates prolonged heating, involving either carburation or decarburation of the surface according to the conditions.

An ingot of grey cast-iron, containing 3·75% total carbon (3·34% graphite), about 0·1% silicon and manganese, and traces of sulphur and phosphorus, was obtained by melting in a crucible some Swedish iron cemented with excess of wood-charcoal, and allowing it to cool slowly. Cubes of this iron (4 cm. edge) were heated for three to seven hours at temperatures varying from 750—1150°, quenched in water, and then annealed at 500°. After planing off a thickness of 2 mm. from the faces, the combined carbon was determined in the remaining cubes. It is found to increase from 0·31% at 750° to 2·47% at 1150°.

A white cast-iron containing 2·82% total carbon (all combined), obtained by running the fused metal into a metallic mould, when heated at 1150°, cooled slowly to 1000°, and then quenched in cold water gives an ingot of which the central portion contains 2·74% total carbon, 1·82% graphite, and 0·92% combined carbon.

When the crucible, prepared as above, containing the liquid iron is placed in a furnace, maintained at 1000° for three hours, and then plunged in cold water, an ingot is formed containing 3·10% total carbon, 2·15% graphite, and 0·95% dissolved carbon.

By the cementation of iron at 1000° (compare Abstr., 1903, ii, 430) with wood-charcoal, two irons were obtained containing (1) 2·50% carbon, of which 1·40% was graphite, and 1·10% dissolved carbon ; (2) 3·10% carbon, 2·21% graphite, and 0·89% dissolved carbon.

The conclusion is drawn that the solubility of graphite in iron diminishes with the temperature, and amounts to about 1% at 1000°.

E. H.

Chemical Behaviour of High Percentage Ferro-silicon. Johannes Haas (*Chem. Zeit.*, 1908, **32**, 8).—A 50% ferro-silicon dissolves in a concentrated solution of copper ammonium fluoride, metallic copper separating as a flocculent, spongy precipitate. The reaction, which takes place spontaneously, is accompanied by a violent evolution of gas, hydrogen silicofluoride probably being formed. Silicic acid is not formed, and the evolution of hydrocarbons has not been observed. The copper ammonium fluoride solution is almost without action on 80% ferro-manganese. G. Y.

Decomposition of Iron Sulphides by Aluminium, and the Probable Existence of a Double Sulphide of Iron and Aluminium. Hugo Ditz (*Metallurgie*, 1907, 4, 786—792).—Sulphides are less energetically reduced by ignition with aluminium powder than oxides. A mixture of iron pyrites and aluminium in the proportion $3FeS_2:4Al$ yields less than one-half of its iron in the metallic form. In presence of an excess of aluminium, one-half of the iron is obtained. The copper present in the pyrites is only reduced when an excess of aluminium is employed. The slag appears to contain a double sulphide, Al_2S_3,FeS, which has also been obtained by Houdard (Abstr., 1907, ii, 468) from ferrous sulphide and aluminium. The reduction thus proceeds according to the equation

$$2FeS_2 + 2Al = Al_2S_3,FeS + Fe.$$

When ferrous sulphide is reduced, the same double sulphide is formed, according to the equation $4FeS + 2Al = Al_2S_3,FeS + 3Fe$.

C. H. D.

Roussin's Salts. V. Italo Bellucci and P. De Cesaris (*Atti R. Accad. Lincei*, 1907, [v], 16, ii, 740—745. Compare Abstr., 1907, ii, 29, 472).—On oxidation of potassium ferronitrosulphide with permanganate, each molecule of the former absorbs 26 atoms of oxygen, this being the amount necessary theoretically for the oxidation of all the elements to the highest grade. This result excludes all possibility of the presence of hydrogen in the molecule of Roussin's salts. Further, taken along with the complete resistance of these salts to the action of the most energetic reducing agents, this oxidisability indicates that most, if not all, of the iron atoms in the molecule are present in the ferrous condition. Comparison of the behaviour towards hydrochloric acid of potassium ferronitrosulphide with that of the complex sulphides, Fe_2S_3,K_2S and $2FeS,K_2S$, shows that the three sulphur atoms in the molecule of Roussin's salts exist in the form of sulphide and are probably combined with the iron.

T. H. P.

Hydrolysis of Ferric Chloride. II. Action of Hydrochloric Acid. G. Malfitano and Leopold Michel (*Compt. rend.*, 1907, 145, 1275—1277. Compare Abstr., 1907, ii, 692).—The authors have compared the rates of change of the conductivity of ferric chloride solutions with that of the conductivity of solutions containing the same quantities of ferric chloride and varying quantities of hydrogen chloride. The results obtained are illustrated by curves. The latter show that the duration of the period of constant conductivity increases with the amount of hydrogen chloride added, and, other things being equal, the quantity of hydrogen chloride required to render the solution stable increases considerably with the temperature and varies slightly with the concentration of the ferric chloride. The remarkable phenomenon is observed, that during the hydrolysis of a ferric chloride solution, a considerably larger quantity of hydrogen chloride can be formed than would have rendered the solution stable if added at first, the conductivity of hydrolysed solutions rising to values greater than those of solutions initially treated with hydrochloric acid. Moreover, small additions of acid only retard hydrolysis at the beginning, afterwards appearing to accelerate it. Measurements of the conductivities of $M/10$ solutions of ferric chloride alone and with varying quantities of hydrogen chloride ($M/30$ to $M/10$) (1) immediately after dissolution, (2) after thirty minutes' heating at 100°, and then (3) forty-six hours later show that the increase in conductivity on heating and its decrease subsequently, diminish as the quantity of acid added increases. The conclusion is drawn that the products of hydrolysis are not constant in composition, only those first formed being easily reconverted into $FeCl_3$ by the hydrochloric acid present, the action of the acid becoming more and more difficult as the hydrolysis progresses, and, further, that the products of hydrolysis are rendered more resistant by the presence of hydrogen chloride. To justify these conclusions, curves are given showing that the amount of hydrochloric acid which, added at the beginning, renders the solution stable, when added during hydrolysis, not only does not restore the solution to its original condition, but does not stop the hydrolysis.

These phenomena appear to be best explained by the hypothesis that the colloid formed from the products of hydrolysis is composed of complex ions. E. H.

Ferric Chlorides. Frank K. Cameron and William O. Robinson (*J. Physical Chem.*, 1907, **11**, 690—694).—The investigation deals with the cases in which there is relatively more ferric oxide than acid. It appears that at 25° no definite basic chloride is formed, the stable solid phase being one of a series of solid solutions containing ferric oxide, hydrochloric acid, and water. J. C. P.

Ferric Sulphates. Frank K. Cameron and William O. Robinson (*J. Physical Chem.*, 1907, **11**, 641—650).—Ferric sulphate solutions of varying concentration were shaken with freshly-precipitated ferric hydroxide at 25° for four months. At the end of this time, the clear solutions were separated and analysed. It is shown that no definite basic ferric sulphates are formed. In contact with solutions containing less than 25% SO_3, the stable solid is one of a series of solid solutions, containing ferric oxide, sulphuric acid, and probably water. In contact with solutions containing from 25% to 28% SO_3, the stable solid is a hydrated normal sulphate of the composition $Fe_2O_3,3SO_3,10H_2O$. In contact with solutions containing more than 28% SO_3, the stable solid is a hydrated acid sulphate of the composition $Fe_2O_3,4SO_3,10H_2O$.

J. C. P.

A New Chromium Sulphate. Paul Nicolardot (*Compt. rend.*, 1907, **145**, 1338—1340).—When the green solution obtained by boiling a solution of violet chromium sulphate is heated with barium carbonate, part of the sulphuric acid is precipitated, and on complete spontaneous evaporation of the filtrate a new *chromium sulphate*, $Cr_2O_3,2 \cdot 5SO_3,7 \cdot 5H_2O$, is obtained as a non-crystalline solid, readily soluble in water to form a green solution, but insoluble in alcohol or acetone, and precipitated from aqueous solution by these liquids. Solutions of the salt do not yield precipitates with barium chloride or with sodium phosphate; it differs in this respect from the sulphate of sulphochromyl hydroxide described, but not isolated, by Recoura (Abstr., 1896, ii, 27), and resembles the sulphate, $(Cr_2O_3(SO_3)_3,8H_2O$, obtained by Recoura by dehydrating the solid violet chromium sulphate. M. A. W.

Chromates. SAMUEL H. C. BRIGGS (*Zeitsch. anorg. Chem.*, 1907, **56**, 246—260. Compare Trans., 1903, **83**, 391; 1904, **85**, 677).—The preparation and properties of certain chromates, dichromates, and double chromates are described.

Nickel dichromate, $2NiCr_2O_7,3H_2O$, obtained by heating together nickel carbonate and chromic acid in aqueous solution at a high temperature, occurs in reddish-brown, transparent prisms, which are deliquescent. The corresponding *cobalt* salt, $CoCr_2O_7,H_2O$, prepared by an analogous method, forms black, lustrous, deliquescent crystals.

Ammonium cobalt chromate, $(NH_4)_2Co(CrO_4)_2,6H_2O$, obtained by interaction of ammonium chromate and cobalt acetate in aqueous solution below −5°, occurs in well-formed, brownish-yellow prisms. The corresponding *cæsium* compound, prepared by an analogous method, was not obtained quite free from basic salt; it forms small, lustrous crystals.

The normal chromates of copper, zinc, and cadmium have already been isolated from aqueous solution and described by Schulze (Abstr., 1896, ii, 24); exact methods for preparing them are now given. Attempts to obtain normal chromates of these metals, analogous in behaviour to the corresponding sulphates, by interaction in non-aqueous solvents were unsuccessful.

A large number of compounds of pyridine with dichromates have been prepared; in most cases by interaction in aqueous pyridine solution of chromic acid or potassium dichromate and a salt of the particular metal. The compounds in question are fairly stable, nearly insoluble in water, and insoluble in the ordinary organic solvents. The majority of them are of the type $M^{\cdot\cdot}Cr_2O_7,4Py$. The *copper* compound, $CuCr_2O_7,4Py$, occurs in small, light green crystals or in well-formed, dark green prisms; the *zinc* compound in lustrous, orange prisms; the *cadmium* compound in orange crystals, and the *cobalt* compound as a dark brown powder. Corresponding *nickel* and *manganese* compounds were also prepared.

A *silver* compound, $Ag_2Cr_2O_7,6Py$, was obtained in lustrous, orange crystals. On dissolving this compound in water containing a little pyridine, and cooling, a second silver compound, $Ag_2Cr_2O_7,4Py$, separated in orange prisms.

Two *mercury* salts of the same composition, $HgCr_2O_7,2Py$, are described. One, obtained from solutions containing little pyridine, forms orange crystals, the other, which crystallises from excess of pyridine, occurs in lustrous, golden-yellow leaflets.

A *uranium* compound, $2UO_3,3CrO_3,2Py$, also forms lustrous, orange-coloured crystals. The pyridine double salts of zinc, cadmium, and mercury darken on exposure to light. G. S.

Potassium Ammoniostannate. F. F. FITZGERALD (*J. Amer. Chem. Soc.*, 1907, **29**, 1693—1698).—In an earlier paper (Abstr., 1907, ii, 545), an account was given of the preparation of potassium ammonio-zincate by the action of zinc on a solution of potassamide in liquid ammonia. Attempts have been made to prepare other salts of this class.

When excess of a solution of potassamide in liquid ammonia is added to a solution of stannic iodide in the same solvent, a crystalline precipitate of *potassium ammoniostannate*, $Sn(NK)_2,4NH_3$, is produced, which, when heated at 145°, loses 3 mols. of ammonia. On further heating in a vacuum at 316°, a brick-red powder is obtained, which still contains some ammonia and is decomposed violently by water with evolution of gas and deposition of tin. E. G.

Columbium Sulphide. I. HEINRICH BILTZ and LUDWIG GONDER (*Ber.*, 1907, **40**, 4963—4972).—For the preparation of columbium pentoxide, a by-product from the manufacture of tantalum compounds was used, containing 46 per cent. of columbium pentoxide, 36 per cent. of sodium oxide, 10 per cent. of iron oxide, traces of tungstic acid, a little tantalum oxide, and several per cent. of water. In order to remove iron, sodium, and tungsten, the product was fused with potassium hydrogen sulphate, water added, the columbic acid filtered off, and then boiled with a little concentrated hydrochloric acid and washed with dilute hydrochloric acid; the fusion was then repeated in order to remove the last traces of iron. The columbic acid was then separated from traces of tantalum according to Marignac's method; it was dissolved in pure hydrogen fluoride, potassium carbonate added, diluted with water, and allowed to crystallise, when a little potassium tantalum fluoride separated; on further concentration, potassium columbium hydroxyfluoride separated. The latter was then heated with concentrated sulphuric acid, fused with potassium hydrogen sulphate, boiled with water, and washed by decantation with dilute hydrochloric acid. The columbic acid, obtained in this manner, was still contaminated with a little sulphuric acid, retained by adsorption. The product was accordingly heated for several hours in a combustion tube, first in a current of ammonia, and finally in a current of oxygen.

The pure columbium oxide was then heated to redness for several hours in a current of a mixture of hydrogen sulphide and carbon disulphide, the product extracted with carbon disulphide, and finally dried over sulphuric acid. It is likely that columbium sulphide has not yet been obtained pure. The authors conclude that their preparations are mixtures of a columbium sulphide, CbS_2 or Cb_2S_5, either with columbium or with a lower sulphide. A. McK.

Mineralogical Chemistry.

Oil from the Roof of the Cockshead Coal Seam, North Staffordshire. ARCHIBALD A. HALL (*J. Soc. Chem. Ind.*, 1907, **26**, 1223—1224).—The dark brown oil, which deposits crystals at 18° and is solid at 15°, was found on investigation to be a mixture of the higher paraffins with some olefines and possibly some naphthenes and phenolic substances. W. H. G.

Optical Investigation of the Bibieibat Naphtha. M. A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1343—1358. Compare Abstr., 1907, ii, 883).—Of forty-seven naphthas examined, those from the uppermost layers are of maximum transparency, and, with but a few exceptions, of lowest sp. gr. The curve expressing the relation between the depth at which the naphtha is obtained and the corresponding coefficients of optical opacity approximates to a straight line; there is thus a genetic connexion between the various naphthas, and they are all filtration products of one original naphtha, but, since this process could not have occurred everywhere at the same speed, the naphthas obtained from various parts of the globe are not identical in properties. The relation between the pressure within the earth and that of the outer layers, as well as of the duration of filtration and the nature of the naphtha produced, is discussed. When the outer pressure exceeds the inner, no filtration can occur, but the naphtha becomes compressed, forming condensed products, such as asphalt (compare Marcusson, Abstr., 1907, i, 466). All the Bibieibat naphthas are normal, are not decomposed, and do not undergo racemisation when distilled at 250°/20 mm. Z. K.

Paraffin Wax from the Ladysmith Pit, Whitehaven Collieries. PETER P. BEDSON (*J. Soc. Chem. Ind.*, 1907, **26**, 1224—1225).—An investigation of a substance which was discovered as an exudation in a drift of the Ladysmith Pit of the Whitehaven Collieries. It is a dark brown material, having the consistency of vaseline, and consists of a mixture of paraffin hydrocarbons, containing a considerable proportion of the solid members of this series, with some olefines. W. H. G.

American Pyrites Crystals. EDWARD H. KRAUS and I. D. SCOTT (*Zeitsch. Kryst. Min.*, 1907, **44**, 144—153).—The following analyses are given of pyrites crystals from: I, Central City Mine, Gilpin Co., Colorado; II, a limestone quarry at Franklin Furnace, New Jersey; III, an unknown locality in Colorado:

	S.	Fe.	Co.	Ca.	Insol.	Total.
I.*	53·26	46·51	—	—	0·59	100·37
II.	53·30	45·20	1·25	trace	0·03	99·78
III.	53·08	46·35	—	—	0·53	99·96

* Ni, Co, As, Sb, and Au are absent.

Detailed crystallographic descriptions are given. L. J. S.

Artificial Hæmatite Crystals. CHARLES E. MUNROE (*Amer. J. Sci.*, 1907, [iv], **24**, 485—486).—Brilliant crystals of hæmatite were found attached to the inside surfaces of iron pipes which for seven years had conducted alternately hydrogen chloride and air in a plant for the manufacture of chlorine by the Deacon process. The well-developed crystals are grouped in rosettes, like the "iron-roses" of the Alps. In a six-inch pipe, the crystals measured 1 cm. across, and in a twenty-inch pipe they were 3 cm. across. L. J. S.

Olivine in Serpentine from Chester, Massachusetts. CHARLES PALACHE (*Amer. J. Sci.*, 1907, [iv], **24**, 491—495).—A narrow vein, two inches or less in width, of olivine occurs in serpentine at Chester, in Massachusetts. The olivine has the form of grains or of rough crystals, and is associated with picrolite, chrysotile, brucite, and magnetite. The following analysis by W. T. Schaller shows that the material, although apparently pure, must be intermixed with magnesite, brucite, and serpentine :

SiO_2.	FeO.	MgO.	MnO.	CaO. F.	H_2O at 100°.	H_2O >100°.	CO_2.	Total.
39·43	7·83	49·26	0·12	nil	1·20	1·49	0·77	100·10

The vein of olivine is very sharply defined from the surrounding serpentine, and is evidently a younger formation, representing a regeneration of olivine in the rock-mass. The serpentine pseudomorphs after olivine from this locality have been called "hampshirite," and recently the opinion has been expressed, but without sufficient grounds, that the original mineral was humite. L. J. S.

Albite from Greenland. C. DREYER and VICTOR GOLDSCHMIDT (*Meddelelser om Grönland*, 1907, **34**, 1—60).—Measurements of well-developed, water-clear crystals of albite from South Greenland give the following crystallographic constants : $a:b:c = 0·6373:1:0·5599$; $\alpha = 94°18'$; $\beta = 116°41'$; $\gamma = 87°37'$. As shown by the following analyses by C. Winther, the material is pure albite : I, of material from Kangerdluarsuk ; II, from Narsarsuk :

	SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	Total.
I.	68·80	19·43	nil	nil	11·86	100·09
II.	68·80	19·40	0·20	,,	11·68	100·08

L. J. S.

Tourmaline from Asinara (Sardinia). AURELIO SERRA (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 702—704).—Large, uniformly tinted, black crystals of tourmaline, D 3·08, found in pegmatitic rock at Asinara, gave on analysis :

SiO_2.	B_2O_3.	Al_2O_3.	FeO.	TiO_2.	P_2O_5.	MnO.	CaO.	MgO.
35·43	9·72	37·29	5·65	0·56	trace	0·89	1·10	4·60

Na_2O.	K_2O.	H_2O at 100°.	H_2O at red heat.	F.	Total.
2·27	0·64	—	1·50	0·12	99·77

The numbers are expressed by the formula :

$$Si_{29}B_{14}Al_{36}Fe_4Mg_6Na_4H_8O_{166}.$$

T. H. P.

Physiological Chemistry.

Effect of Hirudin on Blood-Gases. JOSEPH BARCROFT and G. R. MINES (*J. Physiol.*, 1907, **36**, 275—282).—In work on blood-gases, the principle of leech extract, called hirudin, is a valuable preparation. It may either be injected, or the blood may be received into a suitable syringe containing a small quantity of hirudin solution. If the injection is made slowly, no untoward results follow, and no disturbance of the normal blood-gases is produced. W. D. H.

Sugar in Blood. PETER RONA and LEONOR MICHAELIS (*Biochem. Zeitsch.*, 1908, **7**, 329—337).—The removal of protein by the adsorptive action of kaolin renders the estimation of sugar in the filtrate quite accurate in artificial mixtures containing serum to which a known amount of sugar is added. Colloidal iron hydroxide, although in distinction from kaolin an electropositive colloid, acts similarly. The free sugar of the blood-serum or plasma can therefore be estimated, and the figures obtained by the kaolin method from plasma show the presence of from 92 to 172 mg. of sugar per 100 c.c. Glycogen is also adsorbed and removed by kaolin. In fresh plasma, the yield of sugar after treatment with iron hydroxide is always less than after treatment with kaolin; it is therefore suggested that some of the sugar in the blood is combined with an electronegative colloid. W. D. H.

Proteoses in Blood. ERNST FREUND (*Biochem. Zeitsch.*, 1908, **7**, 361—368).—Abderhalden has stated that even during the height of digestion the blood is free from proteoses. The present paper is largely polemical, and re-affirms the author's previous position on the presence of these substances in the blood. Abderhalden's method is criticised. W. D. H.

Proteins of Horse-Serum. JOHN MELLANBY. (*J. Physiol.*, 1907, **36**, 288—333. Compare Abstr., 1907, ii, 631).—The usual methods of salt precipitation are not regarded as trustworthy for the separation of classes of proteins in serum. Alcohol shows a definite critical temperature for the precipitation of these proteins. The main conclusion drawn is that there are three main proteins present: globulin about 3% of the total, albumin-α about 85%, and albumin-β about 12%; the last named is the crystallisable albumin.

W. D. H.

Leucoprotease and Anti-Leucoprotease of Mammals and Birds. EUGENE L. OPIE and BERTHA L. BARKER (*J. Exper. Med.*, 1907, **9**, 207—221).—The inhibiting action of the blood-serum on the enzyme of the polynuclear leucocytes (leucoprotease) is exerted by the albumin fraction of the serum; the albumin fraction contains no proteolytic enzymes. The globulin fraction contains no anti-enzyme for leucoprotease; it contains, on the contrary, an enzyme which digests proteins in a neutral or alkaline medium. This, which resembles leucoprotease, is held in check by its anti-enzyme which is present in great excess. The anti-enzymotic activity of the serum of different animals varies considerably, that of the rabbit, for instance, being stronger than dog's serum when tested either with dog's or with rabbit's leucoprotease. The serum of birds (pigeon and hen) almost completely fails to inhibit mammalian leucoprotease. The absence of the anti-enzyme is associated with an absence of leucoprotease in polynuclear leucocytes, bone-marrow, and spleen. W. D. H.

Electrical Charge of Native Proteins and Agglutinins. Cyrus W. Field and Oscar Teague (*J. Exper. Med.*, 1907, **9**, 222—225).—Tetanolysin and anti-tetanolysin travel towards the cathode under the influence of an electric current; the specific agglutinins are also electropositive; the protein matter of serum is not amphoteric, but travels towards the cathode whether the reaction is acid, neutral, or alkaline. Hardy's contrary results are attributed to the fact that he worked with "denaturalised" protein. The bacteria-agglutinin combination may be dissociated by means of the electric current. W. D. H.

Oxygen Supply and Saliva. Anton J. Carlson and F. C. McLean (*Amer. J. Physiol.*, 1908, **20**, 457—469. Compare Abstr., 1907, ii, 891).—Further experiments confirming previous results are given. Stimulation of the cervical sympathetic does not increase the percentage of organic solids in the subsequent saliva obtained by stimulation of cranial secretory nerves or by the injection of pilocarpine. Heidenhain's statement to the contrary was due to imperfect technique. This is considered to dispose finally of Heidenhain's theory of trophic secretory nerves. W. D. H.

Causes of Rise in Electrical Conductivity under the Influence of Trypsin. William M. Bayliss (*J. Physiol.*, 1907, **36**, 221—252). —Fall of viscosity and liberation of adsorbed electrolytes from proteins will explain only a small fraction of the increase of electrical conductivity produced by tryptic action. The main cause is the production of "peptones" and amino-acids, and especially of dicarboxylic acids and hexone bases. Amino-acids are more soluble in solutions of other amino-acids than in water, but no evidence of salt formation was obtained. The formation of free carbaminoglycine and carbaminoalanine (Siegfried) is confirmed; carbaminoleucine is also present. W. D. H.

The Relationship of Dysoxidisable Carbon and Nitrogen on Different Diets. Karl Spiro (*Beitr. chem. Physiol. Path.*, 1908, **11**, 144—145).—On a protein diet, the carbon nitrogen (C : N) ratio of the urine falls, because of the increase of urea, in which the C : N ratio is the lowest among urinary constituents. The carbon and nitrogen of the urine which are not in the form of urea or ammonia are spoken of as dysoxidisable; the relationship of this form of carbon and nitrogen is on a flesh diet, 1 : 5; on a carbohydrate diet, 1 : 2·4; on a fat diet, 1 : 3; and in inanition, 1 : 2·38. W. D. H.

The Importance of So-called Plant-amides in Animal Metabolism. VALDEMAR HENRIQUES and C. HANSEN (*Zeitsch. physiol. Chem.*, 1907, **54**, 169—187).—Experiments on rats show that if asparagine is the only nitrogenous substance in the diet, it is unable to maintain equilibrium or to act as a protein-sparer. The same is true for amides separated from eight-day old germinating seedlings (*Vicia faba*, *Phaseolus vulgaris*) or from potatoes and other vegetables.
W. D. H.

Nuclein Metabolism in a Dog with an Eck's Fistula. J. E. SWEET and PHŒBUS A. LEVENE (*J. Exper. Med.*, 1907, **9**, 229—239).—In a dog with an Eck's fistula and on a purine-free diet, the output of uric acid was much higher than in normal animals. Feeding with nucleo-protein only slightly raised the amount. Feeding with adenine had a similar effect, but the experiment was only done once; indeed, the whole series of observations are admittedly too scanty. Nucleic acid caused diuresis and a marked rise in the uric acid output, some of which is attributed to the diuresis. If thymin is injected, part of it is eliminated by the kidneys, but how much is absorbed and how much is decomposed in the intestinal tract was not ascertained. On a low protein diet, the uric acid elimination suffered a marked fall. W. D. H.

The Importance of Allantoin in Uric Acid Metabolism. WILHELM WIECHOWSKI (*Beitr. chem. Physiol. Path.*, 1908, **11**, 109—131).—On administration of uric acid to animals (dogs and rabbits), it is, in part, excreted as such, but is mainly eliminated as allantoin, which is therefore regarded as an end product of uric acid metabolism.
W. D. H.

Secretory Activity of the Pancreas Under the Influence of Hydrochloric Acid and Intestinal Extract. L. POPIELSKI (*Pflüger's Archiv*, 1907, **120**, 451—491).—The work of Bayliss and Starling on secretin is criticised, and the opinion advanced (and supported by experiments) that the injection of hydrochloric acid into the duodenum produces pancreatic secretion as the result of a nervous reflex. It is stated that extracts of all parts of the gastro-intestinal tract produce the same effect as the so-called secretin. W. D. H.

The Nucleic Acid of the Pancreas. OTTO VON FÜRTH and ERNST JERUSALEM (*Beitr. chem. Physiol. Path.*, 1908, **11**, 146—150. Compare Abstr., 1907, i, 993).—The pancreas contains as its principal nucleo-protein one which yields a nucleic acid differing in no essential points from that prepared from the thymus. The pancreas yields also another acid which is distinguished by its solubility in hot water (Hammarsten's nucleo-protein, Bang's β-guanylic acid), and is of simpler structure, its cleavage products being only guanine, phosphoric acid, and pentose. It is to this substance that the name guanylic acid should be restricted. W. D. H.

The Superficial Layer of Cells and its Relation to their Permeability and to the Staining of Tissues by Dyes. T. BRAILSFORD ROBERTSON (*J. Biol. Chem.*, 1908, **4**, 1—34).—From experiments on the solubility of dyes in the presence of lipoids (ethyl acetate, butyrate, triacetin, &c.), the conclusion is drawn that the theory of an oily layer on the surface of cells is untenable, and that cell membranes are probably protein in nature; proteins combine chemically with certain dyes. In many cases, however, a discontinuous lipoid layer may underlie the protein membrane. W. D. H.

The Biological Importance of Lecithin. W. GLIKIN (*Biochem. Zeitsch.*, 1907, **7**, 286—298. Compare Abstr., 1907, ii, 566).—A high percentage of lecithin in the bone-marrow is associated in newly-born animals with those species (both in birds and mammals) in which there is a helpless, immature condition at the time of birth. W. D. H.

Action of Certain Metallic Ions on the Frog's Heart. JEAN GAUTRELET (*Compt. rend.*, 1907, **145**, 1308—1309).—The following metals were dissociated electrically from their chlorides while introduced into the organism of the frog: potassium, copper, and mercury were found to be toxic to the muscular tissue of the heart; magnesium poisons the heart by acting on its nerves. In the case of iron dissociated from ferric chloride, both tissues are affected. Iron dissociated from ferrous chloride, and calcium act tonically on the myocardium; sodium and silver are inert. W. D. H.

Consumption of Dextrose by Mammalian Cardiac Muscle. FRANK S. LOCKE and OTTO ROSENHEIM (*J. Physiol.*, 1907, **36**, 205—220).—A new perfusion method is described by which a solution of dextrose in oxygenated Ringer's solution can be repeatedly circulated through an excised rabbit's heart. Five to ten centigrams of the sugar disappear in eight to nine hours. This is not due to a minor metabolic or fermentative by-process, but is associated with the main chemical change which underlies cardiac activity. If the activity of the heart is reduced by the omission of calcium (or, better, of both calcium and potassium) from the fluid, the amount of sugar used up is lessened. No evidence was found of the formation of disaccharide in the fluid, or of the storage of glycogen in the heart. The amount of carbon dioxide formed runs parallel with the disappearance of sugar. Lactic acid is absent, and nitrogenous waste is very small. W. D. H.

Contraction of Muscle and Receptive Substances. I. JOHN N. LANGLEY (*J. Physiol.*, 1907, **36**, 347—384).—The influence of nicotine on frog's muscles varies in degrees in different muscles. The local application of the drug produces two main kinds of results, namely, local twitchings and prolonged tonic contractions. The former are rarely, if ever, produced, except in the region of the nerve endings. The general bearing of the results recorded is deferred until a future paper, but the theory is suggested that the normal tone of muscles is maintained by an action on the special receptive substance which causes prolonged contraction when stimulated by nicotine, that in some cases this may be restricted to the neural region of the muscle fibre, and that the tone is produced by a constant and not by an interrupted electric current (or stimulus) passing down the nerves.

W. D. H.

Physical Chemistry of Excitation (of Muscle) and of Narcosis. RUDOLF HÖBER (*Pflüger's Archiv*, 1907, 120, 492—516). —Isotonic solutions of normal salts of the alkali metals produce currents of rest of varying intensity and direction when applied locally to the non-injured sartorius muscle of the frog. When arranged according to their power of producing this current, the various anions and cations form two series, which coincide with those which have been deduced from their action on the solubility of egg-white and of lecithin (compare Höber, this vol., ii, 28; also, as regards lecithin, Porges and Neubauer, this vol., ii, 90). This coincidence is one of the reasons for the author's conclusion that excitation and the electrical reaction accompanying it are closely connected with the consistency of the muscle colloids.

Narcotics inhibit the change in the colloids (of the axis cylinder), which change accompanies the normal current of action, and in accordance with the current theory of narcosis, due to Hans Meyer and Overton, this colloidal change is supposed to occur in the lecithin. Narcosis would therefore consist, firstly, in the accumulation of the lipoid-soluble narcotic in the lipoid substance (lecithin), and, secondly, in the inhibition of the colloidal changes which excitation normally produces in this substance.

G. B.

Influence of Inorganic Colloids on Autolysis. Part III. Action of Poisons. M. ASCOLI and G. IZAR (*Biochem. Zeitsch.*, 1907, 7, 142—151. Compare Abstr., 1907, ii, 897).—The effects of various "poisons" on the catalytic acceleration of the autolysis of liver substance have been studied. They agree qualitatively, and to some extent quantitatively, with the effects on the decomposition of hydrogen peroxide by colloidal platinum (Bredig) and by blood catalase (Senter), which effects consist in a retardation of the action of the (inorganic or organic) ferment. A further analogy is especially seen in the case of hydrocyanic acid, namely, that the effect of traces of the poison on colloidal silver is not permanent. After forty-eight hours, the silver recovers its activity, so that it once more accelerates the autolysis.

G. B.

Behaviour of Human Milk to Rennet and Acids. BIANCA BIENENFELD (*Biochem. Zeitsch.*, 1907, 7, 262—281).—Rennet does not curdle human milk; after slight acidification and warming, caseinogen is precipitated by rennet, but this is the effect of the acid, not of the rennet. Lactic acid also precipitates caseinogen, and the precipitate contains only 16·2% of the total nitrogen. The remaining portions are precipitated by three-quarters saturation with ammonium sulphate. Human caseinogen appears to contain a carbohydrate complex.

W. D. H.

Gases Produced in the Alimentary Canal of Goats. Arthur E. Boycott and G. C. C. Damant (*J. Physiol.*, 1907, **36**, 283—287).—Goats produce a large quantity of carbon dioxide (about 9 litres per day in a goat weighing 20 kilos). The amount of combustible gas (hydrogen and methane) varies from 3·5% to 6·6% of this; the proportion between the two gases averaging 1 : 2. Ten % of the total carbon dioxide at least is not the result of tissue metabolism, but leaves the alimentary canal, and is produced there by fermentation.

W. D. H.

The Action of Various Chemical Substances on Sugar Excretion and Acidosis. II. Julius Baer and Léon Blum (*Beitr. chem. Physiol. Path.*, 1908, **11**, 101—108. Compare Abstr., 1907, ii, 640).—A previous research has dealt with the action of glutaric acid in lessening the sugar excretion and acidosis in phloridzinised dogs. Several other acids of the same series were investigated; adipic acid (C = 6) and pimelic acid (C = 7) act in the same way, but less powerfully; suberic acid (C = 8) is still less powerful, and azelaic acid (C = 9) and sebacic acid (C = 10) have no action at all. The higher acids are less easily burnt in the body, more passing unchanged into the urine, but this appears to be only one factor concerned. Benzoic acid does not act like glutaric acid. W. D. H.

Detection of Glyoxylic Acid and its Occurrence in Human Urine. F. Granström (*Beitr. chem. Physiol. Path.*, 1908, **11**, 132—142).—The different colour reactions which indole, scatole, and tryptophan give with glyoxylic acid, formaldehyde, and other aldehydes are described. Eppinger's test for glyoxylic acid in urine is criticised. Although it is sometimes possible to detect indole and scatole, it is very doubtful whether glyoxylic acid ever occurs in human urine, normal or pathological. W. D. H.

Uric Acid of the Urine. Determeyer and Wagner (*Biochem. Zeitsch.*, 1908, **7**, 369—395).—Various factors playing a part in the condition of solution or precipitation of uric acid in the urine are considered. The most important are: (1) solution owing to salt formation with inorganic bases; (2) precipitation of free uric acid by organic acids, and (3) inhibition of this precipitation by certain organic substances, such as urochrome. W. D. H.

Doubly-Refracting Substances from Pathological Organs. Theodor Panzer (*Zeitsch. physiol. Chem.*, 1907, **54**, 239—254).—The crystalline doubly-refracting substance separated from diseased kidneys and previously called protagon is really an oleic acid ester of cholesterol. Further details of its preparation and properties, as obtained from kidneys and other diseased structures, are given, and the question of the meaning of cholesterol in the body discussed.

W. D. H.

Lactic Acid in Eclampsia. A. ten Doesschate (*Zeitsch. physiol. Chem.*, 1907, **54**, 153—168).—Sarco-lactic acid is undoubtedly present in the blood and the urine of the mother, and in the umbilical blood of the fœtus in cases of eclampsia. This substance, however, is not the cause of the convulsions, as has been supposed, but the result either of the convulsions or of the kidney disorder which underlies them. Hopkin's new test for lactic acid was used, and quantitative results in numerous cases given. W. D. H.

Protein Metabolism in Poisoning by Bromobenzene. W. McKim Marriott and Charles G. L. Wolf (*Biochem. Zeitsch.*, 1907, 7, 213—261).—In animals, bromobenzene increases the output of nitrogen; the relation between the different forms of excreted nitrogen is not markedly altered. The sulphur excretion runs parallel to this, the "neutral sulphur" and ethereal sulphates being especially increased. During inanition these effects are still more marked, but there is no acidosis. The drug produces no change in the excretion of amino-acids or in the respiratory quotient. After death, the liver and kidney cells are found to have undergone necrotic changes.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Action of Chlorine in the Tubercle Bacillus. Moussu and Goupil (*Compt. rend.*, 1907, 145, 1231—1232).—The resistance to acids of the various constituents of the tubercle bacillus is one of its characteristic properties, and this is not destroyed by various reagents which destroy the bacilli (alcohol, ether, chloroform, light petroleum, potassium hydroxide, &c.). Exposure to chlorine, however, breaks up the bacilli, and they lose then their acid-resisting property.

W. D. H.

Phosphorus in the Fat of Micro-Organisms. E. Alilaire (*Compt. rend.*, 1907, 145, 1215—1217).—The fatty matter of numerous micro-organisms contains phosphorus. The only exception found was *Chlorella vulgaris*, in which the total amount of fat is small and chlorophyll is abundant. On the supposition that lecithin is present, the iodine test for choline after saponification was tried, but with negative results. W. D. H.

Influence of Organic Matter on Nitrification in Impure Cultures. Adam Karpiński and Br. Niklewski (*Bul. Acad. Sci. Cracow*, 1907, 596—615).—The presence of small amounts of some organic substances is favourable to nitrification in mixed cultures; soil extracts, humates, and acetates were found to be favourable, and even peptone and sugar, in small quantities, quickened nitrification in the first generations. The strength of solutions does not seem to be of much importance, favourable effects being produced, especially in the case of humates, by extremely small amounts. N. H. J. M.

Microbiochemical Formation of Ammonia in Soil. Renato Perotti (*Atti R. Accad. Lincei*, 1907, [v], **16**, ii, 704—709. Compare Abstr., 1906, ii, 304).—Calcium cyanamide undergoes a biochemical change in soil, its nitrogen being converted into ammonia, whilst dicyanodiamide does not undergo this change, but is utilised directly by various organisms. The explanation of this difference in behaviour seems to lie in the fact that calcium cyanamide is poisonous in nature, whilst dicyanodiamide in moderate concentrations is not. When the dicyanodiamide is increased in concentration to such an extent as to render it poisonous, the soil bacteria attack it, converting its nitrogen into ammonia. T. H. P.

Favourable Influence of Small Quantities of Zinc in the Growth of Sterigmatocystis nigra. Maurice Javillier (*Compt. rend.*, 1907, **145**, 1212—1215).—Raulin, in 1870, described the favouring influence of small quantities of zinc on the mould mentioned above, known also as *Aspergillus niger*. Coupin attributed this to the antiseptic action of the zinc preventing the growth of other micro-organisms. The present research confirms Raulin's view that zinc is of real nutritive importance. W. D. H.

The Organic Compounds of Nitrogen, Phosphorus, and Sulphur in Vegetables. Albert Stutzer (*Biochem. Zeitsch.*, 190, **7**, 471—487).—A method for the estimation of phosphorus and sulphur in organic union (as lecithin, &c.) in vegetable tissues is described. Schulze's observations on the value of organic phosphorus compounds in plants, and especially in seeds, are confirmed. After gastric digestion of vegetables, the insoluble residue contains nitrogen, phosphorus, and sulphur in organic combination, but the proportion of the three elements varies. The same is true for the fæces of sheep fed on various vegetables. The nature of the organic sulphur compounds is not known. W. D. H.

Occurrence of Quercitol. Edmund O. von Lippmann (*Ber.*, 1907, **40**, 4936—4937).—An appreciable amount of crystallised quercitol was found between the wood and the bark of a recently felled oak. J. J. S.

Occurrence of Salts of Anhydroxymethylenediphosphoric Acid or Phytin in Plants. Umetaro Suzuki and K. Yoshimura (*Bull. Coll. Agri. Tōkyō*, 1907, **7**, 495—502).—The amount of organic phosphorus soluble in 0·2% hydrochloric acid represents approximately the amount of phytin present in plants. The following results (per cent. in dry matter) were obtained:

	Phosphorus			
			Soluble in 0·2% HCl.	
	Total.	as lecithin.	Organic.	Inorganic.
Rice bran	2·27	0·02	1·68	0·13
Wheat bran	1·114	0·010	0·579	0·050
Seeds of *Sesamum indicum*	0·772	0·030	0·125	trace
Seeds of *Ricinus communis*	0·261	0·013	0·109	trace
Oil cake (*Brassica napus*)	1·195	0·034	0·532	trace
Barley bran	0·541	0·010	0·238	0·089
Bran from *Panicum frument.*	0·765	0·026	0·344	trace

Preparations from rice bran, which amounted to 7—8% of the dry matter, gave the following results: loss on ignition, 27·31; P 23·48, Mg 17·48, and Ca 5·18%. N. H. J. M.

Pectins from the Fruits of Lonicera Xylosteum, Symphoricarpus Racemosa, and Tamus Communis. Marc Bridel (*J. Pharm. Chim.*, 1907, [vi], **26**, 536—543).—The pectins obtained from *Lonicera*, *Symphoricarpus*, and *Tamus* by Bourquelot and Hérissey's method (*ibid.*, 1898, [vi], **7**, 473) gave α_D +183·36°, +190·9°, and +111·42° (200 mm.) respectively. All three yield mucic acid when treated with nitric acid, are coagulated by barium and calcium hydroxides and by pectase, and are rendered incoagulable by malt pectase. The pectin from *Lonicera Xylosteum* yielded arabinose when hydrolysed with sulphuric acid. N. H. J. M.

Composition of Tea Leaves at Various Stages of Development. Shin Sawamura (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 145—146. Compare Kellner, Abstr., 1887, 73).—The relative weights of the first, second, third, and fourth leaves and the twigs were 100, 203, 412, 577, and 717, and they contained respectively 72·48, 71·98, 73·28, 74·54, and 83·91% of water. The composition of the dry matter was as follows:

	Ether extract.	*N*-free extract.	Crude fibre.	Theine.	Tannin.	N.	Pure ash.
1.	6·91	18·40	10·87	3·578	13·97	7·545	4·969
2.	7·90	13·65	10·90	3·559	16·96	6·727	4·988
3.	11·35	18·50	12·25	3·232	15·78	6·294	4·867
4.	11·43	20·73	14·75	2·570	15·44	5·504	4·935
5.	8·03	26·96	17·08	2·146	11·14	5·112	6·249

N. H. J. M.

Carbohydrate Metabolism of the Sugar Beet (Beta vulgaris). Siegfried Strakosch (*Zeitsch. Ver. deut. Zuckerind.*, 1907, **623**, 1057—1068).—The author's results are briefly as follows. Dextrose is formed in the mesophyll of the whole surface of the leaves of *Beta vulgaris*, and is the only sugar found in the mesophyll. The migration of dextrose into the leaf veins is followed by the appearance of lævulose therein, and later by the formation of sucrose. The formation of starch in the chlorophyll granules occurs subsequently to the production of sucrose from its components, and only after the carbohydrates have accumulated to some extent in the mesophyll. Evidence is obtained in support of the view that the sucrose in the leaves of the beet must be regarded as the final product, and that it migrates to the root as such. The conversion of the monosaccharides of the leaf into sucrose is connected with the action of light, and ceases when the leaf is placed in the dark. The amount of the monosaccharides in the leaf is not appreciably altered by the migration of the sucrose into the root. This amount is not perceptibly diminished when the leaves remain in the dark for a long time, neither does prolonged exposure of the leaves to the action of light cause it to increase beyond a certain maximum attained in a short time. T. H. P.

Darkening of Beet Juice. Max Gonnermann (*Zeitsch. Ver. deut. Zuckerind.*, 1907, **623**, 1068—1087. Compare Abstr., 1899, ii, 790).—Sugar beet juice contains organic ferrous salts, tyrosinase, and catechol, the last named being probably formed by the action of tyrosinase on tyrosine. These substances produce no colouring matter in absence of air, but access of the latter to the liquid causes rapid darkening, especially if a trace of ammonia is present. The author has isolated catechol from the juice. T. H. P.

The Most Favourable Ratio of Lime to Magnesia for the Mulberry Tree. M. Nakamura (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 129—133).—The best ratio for mulberry trees was found, in accordance with previous observations by Aso, to be $CaO/MgO = 3/1$. N. H. J. M.

Influence of Stimulating Compounds on Crops under Different Conditions. S. Uchiyama (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 37—79).—A large number of plot experiments are described, in which various plants were grown without and with manganese sulphate. The soil was a diluvial loam rich in organic matter, and contained 0·076% Mn_3O_4 soluble in 1% citric acid, and 0·413% soluble in hot 10% hydrogen chloride. In the case of wheat and barley, very little effect was produced by manganese sulphate, whilst grasses, buckwheat, radishes, carrots, *Brassica campestris*, and tea plants were considerably benefited. Ferrous sulphate was also found to be beneficial in some cases, but less so than manganese. In some cases, a mixture of the two sulphates gave the best results. The amounts of manganese sulphate varied from 10 to 37·5 kilos. per hectare (reckoned as Mn_3O_4). Better results were obtained when it was applied as a top dressing than with the other manures.

Further experiments, in which plants grown in bottomless cylinders received varying amounts of manganese sulphate, showed in each case a more or less stimulating action. In the case of barley, the grain and total yield were increased 18% and 24% respectively by 25 kilos. of Mn_3O_4 per hectare, both smaller and larger applications producing less effect. The effect of manganese depends to some extent on the nature of the soil, being greater on loam than on sandy soil; the effect is diminished by alkaline manures.

Potassium iodide increased the yield of *Panicum miliaceum* (28%) and of barley (34%), the most suitable amounts being 376 and 500 grams per hectare respectively. Sodium fluoride has a powerfully stimulating action on *Panicum*, and also increased the yield of barley; the amounts of fluoride applied were 940 and 5000 grams per hectare. N. H. J. M.

Distribution of Solute Between Water and Soil. Frank K. Cameron and Harrison E. Patten (*J. Physical Chem.*, 1907, **11**, 581—593).—The authors have studied the distribution of various solutes (gentian-violet, sodium eosin, manure extract) between water and various soils. The distribution of solute between solvent and absorbent presents the same general characteristics with soils as with other absorbents. For any series of soils or other absorbents, the order of the absorptive capacities for one solute may be quite different from the order for another solute. The distribution of a solute between solvent and absorbent may generally be represented by the formula $C^n/C_1 = K$, where n may be less than, equal to, or greater than unity. When soils, however, are the absorbents, the flocculation introduces a modifying factor, and the form of the distribution equation may become more complex. J. C. P.

Humus Formation. SHIGEHIRO SUZUKI (*Bull. Coll. Agric. Tokio*, 1907, 7, 513—529. Compare *ibid.*, 419, and Abstr., 1906, ii, 889).—The nitrogen of humus is mainly in the form of a kind of protein, only traces of amino-acids being present. Udránszky's artificial nitrogenous humic acid, obtained by boiling dextrose and urea with hydrochloric acid (*Zeitsch. physiol. Chem.*, 1888, **12**, 42), cannot therefore resemble natural humus.

The following substances were obtained by treating humic acid (500 grams) with hot concentrated hydrochloric acid: alanine, 2·39; leucine, 2·16; aminovaleric acid, 0·57; impure aspartic acid, 2·16; copper salts of active and inactive proline, 0·67 and 0·50; copper salts of unknown acids, 30·30, and ammonia, 1·90 grams. Glutamic acid, tyrosine, and histidine were also present. N. H. J. M.

Sodium Nitrate Compared with Ammonium Sulphate. PAUL BÄSSLER (*Bied. Zentr.*, 1907, **36**, 857; from *Jahresber. Agrik.-chem. Versuchs. u. Samenkontrollstat. Köslin*, 1905—1906, 14).—The greatest effect with potatoes was produced when the manures were applied in two portions, before planting and before the second hoeing. The two manures gave practically the same result. The worst results were obtained by applying the whole amount of the manures before planting; ammonium sulphate produced considerably less effect than sodium nitrate. N. H. J. M.

Behaviour of Nitrate in Paddy Soils. G. DAIKUHARA and T. IMASEKI (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 7—36. Compare Nagaoka, Abstr., 1905, ii, 837).—Results of determinations of dextrose and sucrose in paddy rice and in dry land rice at three or four periods of growth showed that the amount of sugar is practically the same, and, further, that manuring with ammonium sulphate and sodium nitrate respectively has no effect on the sugar content. The low yields of rice obtained when nitrate is employed cannot therefore be due, as suggested by Nagaoka, to deficiency of sugar in paddy plants.

The unsuitability of nitrate for paddy soils is due to loss of nitrogen by denitrification, to the greater production of poisonous nitrites on paddy soils as compared with dry land, and to loss of nitrates by the system of irrigation. Even in the case of dry land there may be some loss by denitrification in the subsoil; in rainy seasons, when organic manures have been applied along with nitrate, denitrification may be energetic in the subsoil and may also take place in the surface soil.

When nitrates are applied to paddy soils, it is best to avoid the use of organic manures unless in a well-rotted condition.

N. H. J. M.

Manurial Effect of Calcium Cyanamide under Different Conditions. S. Uchiyama (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 93—103).—Pot experiments with barley and *Brassica campestris* in loamy and sandy soils. Calcium cyanamide acts best under conditions approaching neutrality. Under favourable conditions, it is equal to ammonium sulphate; the results were less favourable on sandy soil than on loam.

Ammonium sulphate gave better results in conjunction with sodium phosphate than with superphosphate. N. H. J. M.

Manuring with Bone Dust. S. Uchiyama (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 105—120).—The results of sand-culture experiments with barley showed that the availability of bone dust is diminished by magnesite, and that it is less in conjunction with sodium nitrate than with ammonium sulphate. In the case of sandy soil, it was found that potassium sulphate and carbonate in presence of bone dust and sodium nitrate gave similar results. Wood ash and bone dust may therefore be used together.

Bone dust (25 grams) kept in contact with water (2·5 litres) for four and a-half months showed an increase of 70% soluble P_2O_5 over the amount dissolved in the same time in presence of chloroform. The presence of potassium carbonate had a far greater effect than bacteria. N. H. J. M.

Behaviour of Bone and Mineral Phosphates in Soil. Carlo Montanari (*Bied. Zentr.*, 1907, **36**, 797—801; from *Staz. sper. agrar. ital.*, 1906, **39**, 323).—The absorptive power of soils for soluble phosphates depends on the amounts of alkaline earth carbonates, of iron and aluminium oxides, and especially of humus substances.

The continued employment of phosphates diminishes the amount of alkaline earth carbonates in the soil, di- and tri-phosphates being produced. There is also a diminution of alumina and iron oxide, a withdrawal of the alkali of clay producing substances and, consequently, a diminution of the absorptive power of the soil and production of free silicic acid. N. H. J. M.

Are Soils containing less than 0·02% SO_3 Benefited by Special Manuring with Sulphates? G. Daikuhara (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 135—143).—Results of pot experiments in which barley was grown in three soils, containing respectively 0·016, 0·013, and 0·010% of sulphuric acid (as SO_3), showed that these amounts sufficed to meet the needs of barley.

N. H. J. M.

Influence of Solubility on Availability. G. Daikuhara (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 87—91. Compare Abstr., 1906, ii, 388).—When calcium is present as carbonate, the necessary amount of magnesium (as crystallised sulphate) for barley in sand culture is very small, the best ratio of lime to magnesia being 60 : 1. In water cultures containing calcium and magnesium nitrates, the best ratio is between 1 : 1 and 2 : 1. This holds good for sandy soils, whilst in clay soils the ratio $CaCO_3 : MgSO_4$ will vary (compare Nakamura, Abstr., 1906, ii, 389). In the case of barley, the agronomic equivalents of crystallised magnesium sulphate and magnesite are as 4·9 : 100; with rice the equivalent is 9·8. N. H. J. M.

Manuring with Magnesium Sulphate. G. DAIKUHARA (*Bull. Imp. Centr. Agric. Exper. Stat. Japan*, 1907, **1**, 81—86).—Magnesium sulphate is the most effective magnesium compound to employ for regulating the lime factor, and it is best to apply it annually as a top dressing in small quantities. On a loamy humus soil, 10 parts of the salt ($MgSO_4,7H_2O$) are agronomically equivalent to 100 parts of the finest-ground magnesite. N. H. J. M.

Analytical Chemistry.

Gas-generating Apparatus for Analytical Purposes. EUGEN MÜLLER (*Chem. Zeit.*, 1907, **31**, 1257).—A modification of J. M. Sanders's apparatus (*ibid.*, 1184). As now constructed, it consists of a U-tube with two, or only one, ground stoppers and a gas-delivery tube. The advantages gained are: saving of material, obtainment of a pure (washed or dried) gas, and proper regulation of the gas-current. L. DE K.

Estimation of Organically-combined Iodine and Chlorine in "Erythrosine." FERDINAND JEAN (*Ann. Chim. anal.*, 1908, **13**, 12—14 *).—Two portions of 0·5 gram each are burnt to ash, one with addition of 0·5 gram of sodium carbonate, 0·5 gram of potassium carbonate, and 5 grams of magnesium oxide. The ashes are treated with water, the solutions are carefully neutralised with acetic acid, made up to 100 c.c., and the iodine and chlorine are estimated. The difference between the results of the two ashes is then due to organically-combined iodine or chlorine.

The estimation of the halogen is carried out as follows: 50 c.c. of each solution are titrated for iodine only by Pisani's method (*N*/10 silver in presence of iodide of starch). The other 50 c.c. are then titrated with *N*/10 silver for joint iodine and chlorine, using potassium chromate as indicator. L. DE K.

Estimation of Total Sulphur in Urine. HUGO SCHULZ (*Pflüger's Archiv*, 1907, **121**, 114—116).—Ten c.c. of urine are heated in a round-bottomed flask with 10 c.c. of fuming nitric acid; the heating is continued for about fifteen minutes, that is, until all violent action has ceased, and the contents of the flask are then cooled. Water and hydrochloric acid are now added, the solution is transferred to a beaker, and the sulphuric acid is precipitated in the usual way as barium sulphate. W. P. S.

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* And *Bull. Soc. chim. Belg.*, 1908, **22**, 45—46.

Assay of Highly Concentrated Sulphuric Acid. Ernst Buchwald (*Chem. Zeit.*, 1907, 31, 1256).—About 5 grams of the sample are weighed accurately in a small weighing bottle and then made up to a litre. The solution is placed in a burette, and run into a flask containing 50 c.c. of accurately prepared *N*/10 sodium hydroxide, free from carbon dioxide, and coloured with phenolphthalein, until the liquid is decolorised.

Good results are also obtained by Kjeldahl's iodometric process (liberation of iodine from a mixture of potassium iodide and iodate). L. de K.

Titration of Sodium Thiosulphate. Thaddeus Milobendski (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, *Chem.*, 1404—1411).—The three methods of titrating sodium thiosulphate, namely, those of Zulkowsky and of Volhard, and direct titration with iodine, have been found to be equally good; but in cases where the iodine is only very slowly liberated, the thiosulphate should be titrated by Zulkowsky's method without, however, allowing, as usual, half an hour for the completion of the reaction. Z. K.

Modification of Kjeldahl's Process for Estimating Nitrogen in Foods. Remo Corradi (*Boll. chim. farm.*, 1907, **46**, 861—864).—2·5 Grams or, if the amount of the nitrogen is less than 3%, 5 grams of the food are weighed, dried in a steam-oven, and heated for five to six hours in a Kjeldahl flask with 30 c.c. of fuming sulphuric acid. The colourless, or pale yellow liquid, is introduced into a 250 c.c. flask containing about 40 c.c. of water, the cooled solution being then rendered faintly acid by means of 20% sodium hydroxide solution, and finally made up to volume. Twenty-five c.c. of the liquid are then treated with 25 c.c. of sodium hypobromite solution, prepared by mixing 25 c.c. of bromine, 350 c.c. of 30% sodium hydroxide solution, and 275 c.c. of water. The nitrogen evolved is measured in a slightly modified Dupré's azotometer (compare Abstr., 1906, ii, 505), the volume being increased by 1·7%. This method gives numbers differing insensibly from those obtained by the ordinary Kjeldahl process. T. H. P.

Employment of Nitron for Determining Nitrates in Soils and Plants. Jakob Litzendorff (*Zeitsch. angew. Chem.*, 1907, 11, 2209—2231).—Correct results are obtained with soils containing 20—30 parts per million of nitric nitrogen. When, however, smaller amounts are present, the extracts have to be evaporated down, and in this process substances are produced which hinder the separation of the nitrate. This difficulty can be overcome by repeatedly adding hydrogen peroxide to the extract during evaporation, and by heating the sufficiently concentrated extract with hydrogen peroxide in a flask in boiling water for several hours until decolorised. N. H. J. M.

Estimation of Phosphorus in Calcium Carbides. F. WILLY HINRICHSEN (*Chem. Zentr.* 1907, ii, 1356—1357; from *Mitt. K. Materialprüfs.-Amt. Gross. Lichterfelde West*, **25**, 110—112).—On passing impure acetylene through a solution of sodium hypochlorite, explosions occur now and then, and the phosphorus is not completely absorbed, as it occurs, in part, as an organic phosphorus compound.

The process recommended by Lidholm (Abstr., 1904, ii, 776) gives satisfactory results. L. DE K.

A New Modification of Petermann's Method for Estimating Citrate-Soluble Phosphoric Acid in Precipitated Calcium Phosphate (Futterkalk). GUSTAV FINGERLING and ADOLF GROMBACH (*Zeitsch. anal. Chem.*, 1907, **46**, 756—761).—One gram of the sample is put into a 200 c.c. flask and moistened with 5 c.c. of alcohol, 100 c.c. of Petermann's alkaline citrate solution are added, and the whole is rotated for half an hour. The liquid is then heated at 40° for another hour with constant shaking, and, when cold, diluted with water to 200 c.c. and filtered. One hundred c.c. of the filtrate are mixed with 20 c.c. of strong nitric acid, evaporated to half the bulk, and, when cold, neutralised with ammonia and mixed with 50 c.c. of Hallenser's solution. To the cold solution are then added, drop by drop, 20 c.c. of magnesium mixture, and, after shaking for half an hour, the precipitate may be collected. L. DE K.

Detection of Arsenic by Means of the Marsh Apparatus. HEINRICH STRUVE (*Zeitsch. anal. Chem.*, 1907, **46**, 761—764).—The author recommends the use of sheet zinc, which almost invariably he finds to be free from arsenic. Addition of activating agents are superfluous. L. DE K.

Estimation of Commercial Silicon; Separation of Silica and Silicon. FRITZ LIMMER (*Chem. Zeit.*, 1908, **32**, 42).—0·25—0·50 Gram of the finely-powdered sample is heated in a slow current of dry chlorine, care being taken not to apply heat until every trace of air has been expelled from the apparatus. The silicon (also aluminium, iron, &c.) is volatilised, whilst the silica remains in the residue, which is then tested in the usual way by fusion with alkali carbonate, &c. The silica is deducted from the amount of total silica obtained from a separate portion of the sample and the difference calculated into silicon. L. DE K.

Estimation of Carbon in Pig-Iron and Steel. MAX ORTHEY (*Chem. Zeit.*, 1908, **32**, 31—33).—A criticism of some of the methods used for the estimation of carbon in iron or steel. Särnstrom's modified chromic acid process and the copper ammonium chloride method are quite satisfactory for the ordinary kinds of iron. The method of burning in a current of oxygen in presence of bismuth oxide gives good results with all kinds of iron. In the case of samples oxidised with great difficulty, the chlorine process may be used as a check. Some other recognised methods were tried, but with less satisfactory results. L. DE K.

The Use of Silver in the Combustion of Nitrogenous Substances. F. EPSTEIN and RICHARD DOHT (*Zeitsch. anal. Chem.*, 1907, **46**, 771—773).—A silver spiral, 10 cm. long, heated to intense redness is again recommended instead of metallic copper in order to decompose the nitrogen oxides formed in the combustion of nitrogenous organic substances (C and H estimation). Silver also effectually retains halogens. L. DE K.

Dennstedt's Method of Elementary Analysis Applied to the Hæmoglobin Derivatives. JEAN ZALESKI (*Bull. Acad. Sci. Cracow*, 1907, ii, 646—651).—The elementary analysis of substances such as acetonehæmin or iodohæmin (Merunowicz and Zaleski, *ibid.*, 633) is attended with great difficulty when ordinary methods are employed, but is rendered simple by the use of Dennstedt's method (compare Abstr., 1906, ii, 51). G. B.

Estimation of Carbon Dioxide in Electrolytic Chlorine. PETER PHILOSOPHOFF (*Chem. Zeit.*, 1907, **31**, 1256—1257).—The author (Abstr., 1907, ii, 908) now dispenses with the use of brine in order to facilitate the readings, and reads off the volume of the gas before and after absorption by means of a graduated levelling tube attached to the Bunte burette and filled with mercury. L. DE K.

Quantitative Estimation of Metals in Organic Substances. J. ROTHE (*Chem. Zentr.*, 1907, ii, 1362—1364; from *Mitt. K. Materialprüfs.-Amt. Gross. Lichterfelde West*, **25**, 105—106).—The dried substance is heated in a round-bottomed flask with 15 c.c. of fuming nitric acid and 2 c.c. of sulphuric acid for every gram taken, at first gently, afterwards more strongly, on a sand-bath. Substances which are readily inflammable are first moistened with four times the weight of nitric acid, D 1·4. When sulphuric fumes begin to appear, the contents are allowed to cool and another portion of nitric acid is added, and this operation may be repeated if necessary. Finally, the bulk of the sulphuric acid is driven off, and any metal will be found in the residual mass. L. DE K.

Analysis of Sodium Peroxide. R. NIEMEYER (*Chem. Zeit.*, 1907, **31**, 1257).—With care, the permanganate method gives trustworthy results. 0·15—0·2 Gram of the peroxide is weighed out in a little dish placed in a weighing tube. This is then seized with a pair of tongs, and quickly immersed in a beaker containing 500 c.c. of water; care should be taken that none of the peroxide floats on the surface, as otherwise the experiment fails. A sufficiency of dilute sulphuric acid is now added, and the liquid titrated at once with $N/10$ permanganate. L. DE K.

Quantitative Separation of Barium from Strontium. ZELDA KAHAN (*Analyst*, 1908, **33**, 12—14).—The method proposed depends on the precipitation of the barium as chromate in ammonium acetate solution. The solution containing the barium and strontium salts is treated with ammonium dichromate solution until precipitation is nearly complete; the dichromate solution is added drop by drop with constant stirring. Ammonium acetate solution is then added until the solution becomes colourless, a few more drops of the dichromate solution are added so that the solution remains pale yellow, and next, a little more ammonium acetate solution. After the lapse of about three hours, the precipitate of barium chromate is collected in a Gooch crucible, washed with ammonium acetate solution until the filtrate gives only a slight coloration with silver nitrate solution, and is then dried at a temperature of 180° and weighed. W. P. S.

Estimation of Mercuric Chloride in Pastilles. UMBERTO SAPORETTI (*Boll. chim. farm.*, 1907, **46**, 865—867).—The amount of mercuric chloride contained in pastilles used for antiseptic purposes may be readily estimated as follows. Five of the pastilles are dissolved in water in a porcelain basin or crystallising dish with tall sides, and to the solution, decolorised with chlorine water or dilute hydrochloric acid, sodium hypophosphite is added gradually as long as any action takes place. The finely-divided mercury is then caused to collect into a globule by gently boiling the solution, and is washed with dilute hydrochloric acid. The amount of mercury is estimated by weighing or measuring. For the latter estimation, the author has devised a narrow burette or "hydrargyrometer," by means of which the weight of mercuric chloride per five pastilles can be read off directly.

T. H. P.

Estimation of Manganese in Potable Water. EDMUND ERNYEI (*Chem Zeit.*, 1908, **32**, 41—42).—The sample is acidified with sulphuric acid and any iron removed by shaking with a slight excess of zinc oxide. One hundred c.c. of the filtrate are mixed with 5 c.c. of 30% sulphuric acid, the chlorine is removed with slight excess of silver sulphate, and the whole is boiled for twenty minutes after adding 1—2 grams of potassium persulphate. When cold, the liquid is made up to the original volume; the permanganate formed is estimated by adding potassium iodide and titrating with *N*/100 thiosulphate with starch as indicator. The process may be used also for the estimation of manganese in ferruginous water deposits. L. DE K.

Detection of Nickel as Double Nickel Ammonium Molybdate. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 16. Compare Abstr., 1907, ii, 818).—A modification of the author's previous test for nickel. The neutral or slightly acid solution is mixed with a small quantity of saturated solution of ammonium molybdate and then with a large excess of saturated solution of ammonium chloride. The mixture is heated gently, when, should nickel be present, it becomes turbid in a few minutes.

L. DE K.

Volumetric Estimation of Tin by Means of Potassium Dichromate. H. Reynolds (*Chem. News*, 1908, **97**, 13—15).—The process is based on the fact that sulphonated azobenzene is bleached by stannous chloride, and that the red colour is restored by potassium dichromate.

The metal is dissolved in hydrochloric acid in a current of carbon dioxide free from oxygen, a definite amount of potassium dichromate (1 c.c. = 0·01 gram of tin), very nearly sufficient to complete the oxidation, is added, and then sufficient of the indicator to fully mask the green colour of the reduced chromate. More dichromate is now added until the colour changes to red.

The process may be used for the assay of ferro-tin and Britannia metal. L. de K.

New Method for Separating Titanium and Zirconium. Max Dittrich and S. Freund (*Zeitsch. anorg. Chem.*, 1907, **56**, 344—345).—The method depends on the fact that a neutral solution of titanium nitrate gives in the cold with ammonium salicylate a precipitate (titanium salicylate) easily soluble in hot water, whilst the corresponding precipitate with zirconium nitrate is insoluble in excess of the reagent.

A solution of the mixed nitrates, neutralised with sodium carbonate, is added drop by drop to a boiling concentrated solution of ammonium salicylate (1 salt to 5 water). The solution is then boiled for some time, concentrated, filtered, the precipitate washed with a boiling solution of ammonium salicylate until free from titanium, and the zirconium then estimated as dioxide.

The titanium is precipitated from the boiling filtrate with excess of ammonia, and also estimated as the dioxide. G. S.

Separation of Titanium and Thorium by Means of Ammonium Salicylate. Max Dittrich and S. Freund (*Zeitsch. anorg. Chem.*, 1907, **56**, 346—347).—The separation is effected exactly as described in the preceding abstract; thorium, like zirconium, being completely precipitated from a neutralised solution of the nitrate when the latter is slowly added to a boiling concentrated solution of ammonium salicylate. G. S.

Simultaneous Precipitation of Titanium and Zirconium in the Presence of Iron. Max Dittrich and S. Freund (*Zeitsch. anorg. Chem.*, 1907, **56**, 337—343. Compare Abstr., 1905, ii, 287).—Four methods for the simultaneous precipitation of titanium and zirconium salts from a mixture also containing iron are given.

A complete separation in the presence of sodium acetate is possible when the iron is in the ferrous state. The mass obtained by fusing a mixture of the three salts with acid potassium sulphate is dissolved in water, saturated with hydrogen sulphide, filtered, nearly neutralised with sodium carbonate, and the hydrogen sulphide removed by passing a stream of carbon dioxide through the hot solution. Then, whilst the solution is protected from oxidation by means of carbon dioxide, excess of sodium acetate is added, the solution heated for one hour, and the mixed precipitate of titanium and zirconium removed by filtration.

According to another method, which has some advantages, ammonium sulphate is used instead of acetate, otherwise the procedure is the same as above. The titanium and zirconium are obtained as oxides.

The separation in question may also be effected by means of sulphurous acid or sodium thiosulphate; full details are given in the paper.

The titanium in the mixed precipitate is estimated colorimetrically with sulphuric acid and hydrogen peroxide, and the zirconium by difference. G. S.

Separation of Thorium, Titanium, and Zirconium from Iron. MAX DITTRICH and S. FREUND (*Zeitsch. anorg. Chem.*, 1907, **56**, 348—352. Compare preceding abstracts).—It is shown that the complete separation from iron of (*a*) titanium and thorium, (*b*) thorium and zirconium, (*c*) titanium, zirconium, and thorium can be effected by the sodium acetate method described in the preceding abstract. In order to separate the individual oxides from the mixture of the three oxides obtained in (*c*), they are converted into nitrates, the zirconium and thorium are precipitated with ammonium salicylate as described above, and are then separated by the ammonium oxalate method due to Jannasch. G. S.

The Action of Methyl Sulphate on Oils of the Aromatic and Aliphatic Series. THOMAS WEATHERILL HARRISON and F. MOLLWO PERKIN (*Analyst*, 1908, **33**, 2—9).—The authors find that Valenta's method (Abstr., 1906, ii, 310) is untrustworthy for the estimation of tar oils in mixtures of the same with mineral oils. Whilst tar oils are soluble in all proportions in methyl sulphate, mineral oils are not insoluble. The method is, however, of use qualitatively; methyl sulphate removes most of the tar oil together with only a small quantity of mineral oil when shaken with mixtures of these oils. If the methyl sulphate layer is then saponified with potassium hydroxide and the solution diluted and extracted with ether, the tar oil, mixed with only a small portion of mineral oil, is recovered. It can then be tested to prove that it is a tar or aromatic oil. The fact that methyl sulphate dissolves a portion of an oil is no proof that the dissolved portion is an aromatic hydrocarbon. W. P. S.

Estimation of Naphthalene in Coal Gas and in Spent Oxide of Iron. C. J. DICKENSON GAIR (*J. Soc. Chem. Ind.*, 1907, **26**, 1263—1264).—The method described previously (Abstr., 1906, ii, 201) has been modified as follows, so as to be available either gravimetrically or volumetrically. The naphthalene picrate obtained is collected on a filter and washed with about 400 c.c. of dilute picric acid solution to remove the acetic acid, and is then washed into a beaker with a little cold water; 180 c.c. of water are added together with 25 c.c. of $N/10$ sodium hydroxide solution and the mixture is boiled for ten minutes, with the result that the naphthalene is liberated. If on testing with lacmoid indicator the solution does not give a green coloration, a further quantity of sodium hydroxide is added and the boiling continued. *N*/20 picric acid solution is now added in excess, as is shown by the indicator becoming yellowish-brown, and the solution is titrated with *N*/10 sodium hydroxide solution until the green coloration is permanent. The quantity of sodium hydroxide solution required to decompose the naphthalene picrate is thus found; 1 c.c. of *N*/10 sodium hydroxide solution corresponds with 0·0128 gram, or 0·197 grain, of naphthalene.

For the estimation of naphthalene in spent oxide of iron, 10 grams of the undried oxide are placed in a closed flask and extracted with 100 c.c. of 80% alcohol. At the end of three hours, the solution is poured through a filter, the residue is washed with dilute alcohol, and to the filtrate are added 300 c.c. of concentrated picric acid solution. After a short time, the naphthalene picrate is collected on a filter, and the naphthalene is then estimated volumetrically as described above, except that there is no necessity to wash the picrate before decomposing it with sodium hydroxide solution. W. P. S.

Estimation of Alcohol in Wine. MARCEL DUBOUX and PAUL DUTOIT (*Ann. Chim. anal.*, 1908, **13**, 4—9).—Five volumes of redistilled aniline are mixed with 3 volumes of alcohol (95° French). A mixture of 1 volume of nitrobenzene and 9 volumes of alcohol may be used also. Fifteen c.c. of the mixture are placed in a test-tube, 3·5 cm. in width and 15 cm. long, fitted with a doubly-perforated cork through which pass a delicate thermometer and a glass stirrer bent upwards at the lower end. Ten c.c. of the alcoholic solution (wine-distillate) are added, and the whole is heated with constant stirring until a clear solution is obtained. The temperature at which this occurs is noted and reference made to a table constructed from similar experiments made with alcoholic mixtures of known composition.

L. DE K.

Formation of Methylacetol (Acetylmethylcarbinol) in the Acid Fermentation of Wines. J. PASTUEREAU (*J. Pharm. Chim.*, 1908, [vi], **27**, 10—12).—The author states that acetylmethylcarbinol is a normal constituent of wine-vinegars, and that it is formed during the acetic fermentation of the wine. Its presence may be ascertained and its amount determined by subjecting the neutralised vinegar to distillation under reduced pressure or by passing a current of steam. The ketone is then estimated in the distillate either by Fehling's solution or by means of ammoniacal silver nitrate containing sodium hydroxide. 2·85 Grams of copper reduced = 1 gram of methylacetol; 4 atoms of silver = 1 mol. of methylacetol.

Methylacetol is also characterised by yielding with phenylhydrazine acetate an osazone melting at 243°, of which the corresponding osotetrazone melts at 151°. With semicarbazide, a semicarbazone is obtained melting at 200°. L. DE K.

General and Physical Chemistry.

Chemistry in Space. Giacomo L. Ciamician (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 3—4).—A reply to Paternò (this vol., ii, 77).
T. H. P.

Stereoisomerism and the Law of Entropy. Arthur Michael (*Amer. Chem. J.*, 1908, **39**, 1—16).—A theoretical paper, in which attention is drawn to the intimate connexion between the energy relations of stereoisomeric compounds and their chemical behaviour.
E. G.

State in Solution of the Camphorcarboxylates of Aliphatic and Aromatic Amines as revealed by the Rotatory Power. Jules Minguin (*Compt. rend.*, 1908, **146**, 287—290. Compare Abstr., 1905, ii, 130).—The author has measured the rotatory power of $M/100$ solutions of camphorcarboxylic acid (1) alone; (2) containing equivalent quantities of propyl-, butyl-, diethyl-, and triethyl-amine, and (3) containing excess of the same amines, and finds that the deviations of the rotatory power of solutions (3) from that of solutions (1) are practically the same as those of the rotatory power of solutions (2) from that of solutions (1), showing that the aliphatic amine camphorcarboxylates are undissociated, or only very slightly dissociated, in solution. Moreover, the results verify the law (Haller and Minguin, Abstr., 1903, i, 267) that in the same optically active homologous series the same fraction of the molecular weight under the same conditions produces the same deviation. The aliphatic amines in their capacity as solvents have no influence on the rotatory power. *Propylamine camphorcarboxylate* forms crystals, m. p. 110° (decomp.); the *diethylamine* salt has m. p. 124°, and the *butylamine* salt, m. p. 155°.

Measurement of the rotatory power of $M/300$ solutions of camphorcarboxylic acid in alcohol, ether, benzene, toluene, xylene, and acetone, and of the same solutions containing an equal molecular quantity of aniline, shows that the optical activity of the acid is largely influenced by the solvent, and that the addition of aniline has practically no effect. The conclusion is drawn that *aniline camphorcarboxylate* (solid, m. p. 65° decomp.) is completely dissociated in solution. Excess of aniline lowers the rotatory power from $\alpha^{12} = 3°$ (in 2-dcm. tube) with an equivalent amount of aniline to $\alpha^{12} = 1°26'$ with all aniline. This change is probably due both to the formation of an aniline salt of a lower rotatory power than that of the acid (since α reaches a constant value with the concentration $70M/300$ of aniline), and to the influence of the aniline as a solvent.

Addition of a large excess of aniline to a $M/100$ solution of camphorcarboxylic acid and triethylamine very considerably reduces its rotatory power, and that this is not due to the displacement of the amine from triethylamine camphorcarboxylate by aniline is shown by the fact that a similar, although smaller, reduction is produced when equivalent quantities of both amines (both largely in excess of the acid) are added to a $M/100$ solution of the acid. A similar phenomenon is observed with butylamine camphorcarboxylate.

The camphorcarboxylates of methylaniline, dimethylaniline, ethylaniline, *o*- and *m*-toluidine, and *α*- and *β*-naphthylamine are likewise completely dissociated in solution, and these amines act similarly to aniline towards the aliphatic amine salts. E. H.

Resolution of the Spectral Lines of Barium, Yttrium, Zirconium, and Osmium in a Magnetic Field. BURTON E. MOORE (*Ann. Physik*, 1908, [iv], **25**, 309—345).—An attempt has been made to discover series in the spectral lines of certain metals by grouping together those lines which show a similar behaviour in the magnetic field. In the spectra of the metals examined, the types discovered are very complicated, and very few regularities, applicable to more than a small number of lines, could be observed. Yttrium and zirconium are particularly rich in new types of resolution. Runge's rule, that the distances of the components from the middle are aliquot parts of the "normal distance," is confirmed.

C. H. D.

Spectrum of Strontium in the Orange and Red. PETER JECHEL (*Chem. Zentr.*, 1907, ii, 1588—1589; from *Zeitsch. wiss. Photochemie*, 1907, **5**, 322—339).—The spectrum of strontium has been photographed with the aid of a large Rowland concave grating, the source of light being an electric arc between carbon poles; the positive carbon is drilled and filled from time to time with strontium chloride. The strontium spectrum in the orange and red consists of five groups of lines and bands, which are described in detail. The results agree satisfactorily with Deslandres's formula. G. Y.

Energetics and Chemistry of Banded Spectra. JOHANNES STARK (*Physikal. Zeitsch.*, 1908, **9**, 85—94).—A theoretical paper dealing with the structure of the atom considered as an aggregation of electrons. Two types of electrons are distinguished: the one type, arranged in the form of a ring, represents the positive electricity of the atom, and the second type consists of negative electrons which neutralise the positive charge of the ring and are separated from the atom when ionisation takes place, these being termed valency electrons. Banded spectra are supposed to be determined by the valency electrons, the energy radiated when the valency electrons enter into combination with the positively charged atomic groups representing the potential energy corresponding with the separation of the valency electrons from the atomic aggregates. Three kinds of valency electrons are also distinguished, and the characteristics of banded spectra are discussed in terms of these three types. H. M. D.

Anomalous Modifications of the Band Spectra of Different Compounds in the Magnetic Field. A. DUFOUR (*Compt. rend.*, 1908, **146**, 229—231).—The band spectra of strontium and barium fluoride, and of calcium, strontium, and barium chlorides, obtained by volatilising the salts in a flame placed in the centre of a Weiss electromagnet, exhibit similar anomalous modifications to those observed in the case of calcium fluoride (*ibid.*, 118). M. A. W.

Spectra of Non-dissociated Compounds. HENRI BECQUEREL (*Compt. rend.*, 1908, **146**, 257—259. Compare *ibid.*, 153).—Polemical against Dufour (preceding abstract) (compare also Jean Becquerel, Abstr., 1906, ii, 317; this vol., ii, 3; Wood, this vol., ii, 150; Henri Becquerel, Abstr., 1889, 553). E. H.

Spectrum of the Ruby. A. MIETHE (*Ber. Deut. physikal. Ges.*, 1907, **5**, 715—717).—In addition to the absorption band noticed by Vogel, the spectrum of the ruby is characterised also by a number of absorption lines, particularly two very close together in the red. These two lines, which with a pocket spectroscope are seen as one line, appear to be due to chromium. The author shows that there is a simple connexion between the position of the absorption lines and the fluorescence lines of the ruby. J. C. P.

Absorption of Light in Solutions of Aniline Colours from the Standpoint of Optical Resonance. STANISLAW KALANDEK (*Physikal. Zeitsch.*, 1908, **9**, 128—134).—According to Kossonogoff's theory (*Physikal. Zeitsch.*, 1903, **4**, 208, 258), the absorption bands of a given coloured substance should be displaced towards the red end of the spectrum when the substance is dissolved in solvents with increasing refractive powers. The absorption bands of four colouring matters dissolved in aniline and ethyl alcohol, and of two others in aniline and water, have been compared. The requirements of the theory are satisfied qualitatively in five cases, but with corallin, in aniline and ethyl alcohol, the displacement of the bands is in the opposite direction from that indicated by the theory. An attempt is made to explain the quantitative deviations which are met with in all the cases examined.

The changes in the absorption spectra, which take place when the concentration and thickness of the absorbing column are varied, are also recorded for a number of substances dissolved in water and ethyl alcohol. H. M. D.

Detection of Ultra-violet Rays. CARL SCHALL (*Chem. Zentr.*, 1907, ii, 1442; from *Phot. Woch.*, 1907, **33**, 321—322).—Paper soaked in a solution of 1 gram of *p*-phenylenediamine in 4 c.c. of dilute nitric acid (2 c.c. acid, D 1·2, and 3 c.c. water) and dried rapidly over a bunsen flame is recommended as test paper for ultra-violet rays. On exposure to ultra-violet light, the paper becomes blue, less so on exposure to white light. The paper remains unchanged in daylight in a room, but becomes grey or greyish-blue in the open. The blue colour is produced instantaneously by the rays from a quartz lamp, more slowly by those from a uviol lamp. The rays from gas, Auer, electrical glow, and Nernst lamps do not affect the paper. The spectrum of the Heraeus lamp has a blue band extending into the ultra-violet. G. Y.

Changes in the Colour of Calcium Sulphide under the Influence of Light. José R. Mourelo (*Arch. Sci. phys. nat.*, 1908, [iv], **25**, 15—25).—When calcium sulphide is prepared by heating calcium oxide, obtained from different forms of the carbonate, with sulphur or in a current of dry hydrogen sulphide, the white or greyish-white colour of the sulphide is found in many cases to change into a reddish-violet when the substance is exposed to light. Sulphides prepared from calcium sulphite, thiosulphate, or sulphate do not exhibit this colour change. The exact conditions for the production of the colour-sensitive sulphide could not be ascertained, for pure and impure calcium carbonates, natural and artificial, sometimes yield a colour-sensitive sulphide, and at other times, under the same con-conditions, a sulphide is obtained which is quite inert towards light. The colour-sensitiveness seems to be independent of the phosphorescent power, some samples with strongly, and others with very feebly, developed phosphorescent properties exhibiting the same sensitiveness towards light in regard to the colour change. Experiments are described which indicate that the change in colour is confined to the surface of the sulphide exposed to light. The observed effects are not attributable to oxidation, and are referred to chemical changes directly induced by light. H. M. D.

Pseudo-reversible Photochemical Processes. Photochemical Cyclic Action. Robert Luther and Joh. Plotnikoff (*Zeitsch. physikal. Chem.*, 1908, **61**, 513—544).—An example of pseudo-reversible photochemical action is furnished by the oxidation of oxalic acid by atmospheric oxygen in presence of light and iron salts. A solution of ferrous oxalate, when kept in the dark in contact with air, changes colour and is oxidised to ferric oxalate. If this solution containing ferric oxalate is exposed to bright light, reduction takes place, ferrous oxalate is regenerated, and carbon dioxide is liberated. This reaction is not a perfectly reversible one, because there is involved an irreversible change, namely, the oxidation of oxalic acid by atmospheric oxygen. It is a case of cyclic action ("Uebertragungskatalyse").

Another case of photochemical catalysis, studied quantitatively by the authors, is the oxidation of phosphorous acid by atmospheric oxygen in presence of light and iodine. The reactions here involved are: (1) $2HI + O = I_2 + H_2O$, a change which is slow in the dark, but rapid in light (see Plotnikoff, Abstr., 1907, ii, 212); (2) $H_3PO_3 + H_2O + I_2 = H_3PO_4 + 2HI$, a reaction which takes place rapidly, and on which light has no influence (see Federlin, Abstr., 1903, ii, 14). The authors show that in the absence of iodine the velocity of the irreversible change, $H_3PO_3 + O = H_3PO_4$, is negligibly small either in the dark or in light.

The kinetics of the separate reactions and of the total reaction are considered from the theoretical point of view, and formulæ are deduced for the course of the photochemical change. The results of the experimental work which the authors have carried out are in harmony with their formulæ. Thus the equilibrium concentration of the iodine is proportional to the intensity of the light, proportional to the velocity of the photochemical reaction, and inversely proportional to the velocity of the opposing reaction (2). It is found, also in harmony with theory, that rise of temperature favours the opposing reaction. From the authors' work, the general conclusion may be drawn that the laws governing pseudo-reversible photochemical reactions resemble very closely those to which perfectly reversible reactions are subject.

The paper contains a description of an apparatus which provides for the constant saturation of a liquid with oxygen, and at the same time permits a determination (from the diminution in volume) of the rate at which the oxygen is reacting with the liquid. J. C. P.

The Atomic Weight of Radium. HENRY WILDE (*Mem. Manchester Phil. Soc.*, 1907, **52**, No. 1, 1—3).—The author has previously expressed the view that the atomic weight of radium is 184 (Abstr., 1907, ii, 149); this view is now confirmed by a calculation of its equivalent, which proves to be 92, from the ratio Ag : $RaCl_2$.
P. H.

Decay of Radium-*B* and -*C* at High Temperatures. HEINRICH W. SCHMIDT (*Physikal. Zeitsch.*, 1908, **9**, 113—117. Compare Makower and Russ, Abstr., 1907, ii, 421; Bronson, Abstr., 1905, ii, 567).—The question as to whether radioactive change is influenced by high temperatures has been again examined experimentally. The method was similar to that adopted by Bronson (*loc. cit.*). The conclusion is drawn that the rate of decay of radium-*C* is independent of the temperature up to 1300°. This result does not agree with the observations of Makower and Russ (*loc. cit.*), who found that the rate of decay of radium-*C* was smaller at high temperatures than at room temperature. H. M. D.

Radio-Lead. BELÁ SZILARD (*Compt. rend.*, 1908, **146**, 116—118). —The object of this work is to determine how the radiums *D*, *E*, and *F* are separated from the substance known as radio-lead by certain chemical reactions. Recrystallisation of the nitrate from a neutral solution gradually removes the radium-*F* (polonium), which remains in the mother liquor, but does not appreciably influence the amounts of radiums *D* and *E* in the crystals. The same separation can be effected in a strongly acid solution. Addition of sodium ethyl sulphate to a solution of a salt of the active lead, gives, after a time, a slight precipitate containing the greater part of the radiums *E* and *F*, but only a trace of radium-*D*.

Dissolution of radioactive lead carbonate in concentrated sulphuric acid, and evaporation of the filtrate to dryness, leaves a residue only slightly enriched in radium-*D*. Commercial carbamide, but not the pure substance, gives a rosy precipitate in active lead solutions, which contains a great part of the radiums *E* and *F*, but very little of radium-*D*. Ammonium carbonate gives a similar, but less active, precipitate. The latter seems to be a true chemical reaction, and the precipitate has almost the same activity immediately after formation as after several days. Hofmann and Zerban showed (Abstr., 1902, ii, 211; 1903, ii, 732) that the double thiosulphate of sodium and active lead decomposes spontaneously, giving a precipitate of which the first fractions are more active than those following. The author finds that this reaction is influenced both by light and by filtration, the formation of the precipitate being hastened by these agencies, whilst its composition is changed, its colour becoming red if produced in a strong light. The first fraction is the most active, and contains five to seven times more radium-*D* than the later fractions. The latter have all about the same activity, but contain very little radium-*D*, of which the greatest part remains in solution. If the first fraction is reconverted into nitrate, a second precipitation gives a better yield. In some cases, the separation of the active substances is influenced advantageously by light.

Removal of radium-*D* has not been effected, radium-*F* (polonium) can be removed by many chemical reactions, and radium-*E* also with a little more difficulty. Radiums *E* and *F* in some cases can be removed simply by addition of a substance in suspension. The time constant of radium-*E* corresponds in certain cases with that of radium-E_1 and, in others, with that of radium-E_2. E. H.

Penetrating Radiation. W. W. Strong (*Physikal. Zeitsch.*, 1908, **9**, 117—119).—Three lines of evidence are brought forward to show that the greater part of the ionisation observed in closed vessels is due to a penetrating form of radiation emitted by radioactive substances present in the atmosphere. In the first place, the radium content of the earth's surface is too small to account for the observed ionisation effects. Secondly, the ionisation is found to vary with changes in the atmospheric conditions; with normal atmospheric conditions, diurnal variation similar to that exhibited by temperature can be traced. Thirdly, constant ionisation values are observed in caves, there being no evidence of diurnal variation. H. M. D.

Have *X*-Rays an Action on Radioactive Substances? Charles E. Guye, A. Schidlof, and M. Kernbaum (*Arch. Sci. phys. nat.*, 1908, [iv], **25**, 26—35).—Experiments have been made to ascertain whether the rate of decay of the activity of radioactive substances is altered when they are subjected to the action of *X*-rays. The substances examined were polonium, the induced activity from radium, an impure radium compound, and radium emanation; the rate of decay of these when acted on by *X*-rays being directly compared with the rate when not subjected to this influence. In no case was any definite difference observable. H. M. D.

So-called Moser-Rays. Elisabeth Légrády (*Zeitsch. Photochem.*, 1908, **6**, 60—67).—The photochemical action exhibited by certain metals in the dark has been investigated. By means of a small, gas-tight chamber provided with inlet and outlet tubes, the influence of different gases and of moisture on the activity of the metals could be examined.

In the absence of metals, the photographic plates were not acted on when dry air, nitrogen, or hydrogen was passed through the chamber. A negative result was also obtained with dry air and nitrogen in the presence of freshly-polished aluminium, cadmium, magnesium, and zinc, but the plates were acted on when the gases were not dried. Hydrogen was found to be active in the presence of the above metals whether dried or moist.

From these observations, the author draws the conclusion that the metals, *per se*, have no photochemical properties, and that the observed photochemical effects are dependent on the presence of hydrogen (or hydrogen compounds). The directly active agent is supposed to be ionised hydrogen, which is produced from molecular hydrogen (or from water) by the action of the metals.

Experiments are also described which show that the action cannot be attributed to the emission of active rays by the metals, or by the ionised hydrogen. Certain metals appear to exhibit two kinds of photochemical activity, but the second type, which gives rise to light pictures, has not been examined in detail. H. M. D.

Radioactivity of the Kissingen Mineral Springs. FELIX JENTZSCH (*Physikal. Zeitsch.*, 1908, **9**, 120. Compare this vol., ii, 9).—The author withdraws his criticism of the formula used by H. W. Schmidt (*Physikal. Zeitsch.*, 1906, **7**, 209) for calculating the radioactivity of mineral waters from ionisation experiments. The difference between this formula and that employed by the author is due to a slight modification in the experimental method.

The numbers previously given for the water of the Rakoczy spring are recalculated on the assumption that the natural radiation in a closed electroscope is to be referred to causes other than the emanation present in the air. Data are given for the activity of samples of Rakoczy water which have been kept for periods reaching to three years. The activity decreases for about fifteen months and then increases, and it is suggested that this may be due to the gradual formation of an emanation-emitting substance. H. M. D.

Radioactivity of the Waters of Lavey-les-Bains. ED. SARASIN, CHARLES E. GUYE, and JULES MICHELI (*Arch. Sci. phys. nat.*, 1908, [iv], **25**, 36—44).—The radioactivity of the Lavey springs has been measured by the method of Elster and Geitel, and found to be 11 in terms of Mach's unit. With the exception of the Dissentis springs, this represents a radioactivity of much greater magnitude than that of any Swiss waters which have been examined. The activity is probably due to radium emanation, since it falls to the half value in four days. H. M. D.

Radioactivity of the Waters of Plombières. ANDRÉ BROCHET (*Compt. rend.*, 1908, **146**, 175—177).—The author has determined the radioactivity of minerals and other solids, of gases, and of waters collected in Plombières. That of the solids is either zero or approaches the limit of sensitiveness of the apparatus (a Curie electroscope having an aluminium leaf and micrometer, adapted to a condenser).

Three hours after collection, the gas from the Vauquelin spring had a radioactivity of 14·9; from the Thalweg gallery, 13·6, and that from the Savonneuses gallery, 6·1, expressed in milligramme-minutes per 10 litres of gas. For the former two gases, Curie and Laborde found 5·7 and 3·2 respectively, but their experiments were made four days after collection.

The radioactivity of the gas extracted from the water from Vauquelin (temperature 69°) is 0·84 (Curie and Laborde found 0·22); of Roman Robinet (temperature 70°), 0·43; from the Capucins (temperature 46°), 2·03 (Curie and Laborde found 0·46), and from the Savonneuses gallery, No. 1 (temperature 22°), 0·75, No. 2 (temperature 28°), 1·29. The emanation extracted from the water from the Capucins loses half its activity in four days. The results establish the fact that there is no relation between the radioactivity of the waters and their temperature. E. H.

Anomalous Behaviour in the Radioactivity of Certain Uranium Compounds. HERMAN SCHLUNDT and RICHARD B. MOORE (*Physikal. Zeitsch.*, 1908, **9**, 81—85).—When excess of a hot 4-normal ammonium carbonate solution is added to a nearly saturated solution of uranyl nitrate, the uranium and uranium-*X* both dissolve completely. On cooling, crystals of the double carbonate,

$$UO_2CO_3,2(NH_4)_2CO_3,$$

separate, but the whole of the uranium-*X* remains dissolved.

The radioactivity of the double carbonate increases after a time, a maximum being attained at the end of about twelve days. A similar increase takes place when the substance is gently heated. In both cases, the increase in activity is accompanied by a slight deepening of the yellow colour of the crystals. The phenomenon appears to be due to the decomposition which the substance undergoes, the removal of ammonia, carbon dioxide, and water resulting in a diminution of the retardation of the particles which are emitted by the active element contained in the compound. The increase in the activity is proportional to the loss of weight, a similar effect being observed when thin layers of uranyl acetate and nitrate are gently heated. The experimental results are compared with the calculated increases in activity, assuming that the retarding power of the volatile products of decomposition is inversely proportional to the square root of the atomic weights of the elements contained in these products.

H. M. D.

Association of Helium and Thorium in Minerals. ROBERT J. STRUTT (*Proc. Roy. Soc.*, 1907, **80**, *A*, 56—57).—Boltwood (Abstr., 1907, ii, 220) has recently suggested that the helium in radioactive minerals always originates from the uranium-radium series of transformations. The author has now examined a mineral from Greenland yielding helium, which contains only traces of radium, much too small to account for the helium present, but yields abundant thorium emanation; he therefore considers that the helium in this case is a product of thorium radioactivity. G. S.

Ionium. WILLY MARCKWALD and B. KEETMAN (*Ber.*, 1908, **41**, 49—50).—The authors' investigations confirm the results obtained by Boltwood (Abstr., 1907, ii, 836) and Hahn (*ibid.*, 921). Attempts to separate ionium and thorium have as yet been unsuccessful.

An investigation of autunite shows that 10 grams of this mineral does not contain so much as 0·1 mg. of lead; this is remarkable, since lead is generally supposed to be the final product of the transformation of uranium. W. H. G.

Amalgam Concentration Cells, Chemical Cells, and Daniell Cells Constructed with Solid Electrolytes. M. KATAYAMA (*Zeitsch. physikal. Chem.*, 1908, **61**, 566—587).—The *E.M.F.* of the cells referred to was measured by the usual compensation method, except that a quadrant electrometer was employed as zero instrument.

The first type of cell studied was Pb amalgam c_1 | solid $PbBr_2$ | Pb amalgam c_2, and it is shown that the *E.M.F.* of such a cell may be calculated by the formula $E = RT/2F.\log c_2/c_1$, where c_2 and c_1 are the concentrations of the lead in the two amalgams.

The chemical cells were of the type Metal | Metallic haloid | Halogen, and many precautions, detailed in the paper, must be observed if trustworthy values for the *E.M.F.* of such a cell are to be obtained. The cells actually examined were as follows: Ag | solid AgCl | Cl, for which $E = 1·130 + 0·0006\ (20 - t)$ between 15° and 159°; Pb | solid $PbCl_2$ | Cl, for which $E = 1·581 + 0·00065\ (60 - t)$ between 60° and 155°; Pb | solid $PbBr_2$ | Br, for which $E = 1·338 + 0·00065\ (60 - t)$ between 60° and 162°.

Three cells of the type of the Daniell element were also constructed and studied, with the following results: Pb | solid $PbCl_2$ | solid AgCl | Ag, $E = 0·480 + 0·0001\ (60 - t)$ between 23° and 151°; Pb | solid $PbBr_2$ | solid AgBr | Ag, $E = 0·342 + 0·00025\ (20 - t)$ between 20° and 145°; Ag | solid AgCl | solid AgBr | Ag, $E = 0$, except for slight differences due to experimental errors. J. C. P.

Concentration Cells. I. Cadmium Chloride Cells. EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1506—1521).—Three kinds of concentration cells were investigated in various cadmium chloride solutions: (1) those in which there is no transport of an ion; (2) those in which the anion is transported; (3) those in which the cation is transported.

Curves are drawn showing the relation between the logs. of concentration of the solution and the corresponding *E.M.F.* for the three cases. The following concentration cells were studied: Cd | $m$$CdCl_2$aq | $n$$CdCl_2$aq | Cd; Cd | $CdCl_2$aq.KCl | HgCl.Hg; Hg.HgCl | $m$$CdCl_2$aq | $n$$CdCl_2$aq | HgCl.Hg; Ag.AgCl | $m$$CdCl_2$aq | $n$$CdCl_2$aq | AgCl.Ag; Cd | $m$$CdCl_2$aq | AgCl.Ag.AgCl | $n$$CdCl_2$ | Cd (where m and n are the concentration of the solutions and $m > n$.

It is impossible to apply Moser's method here for the calculation of the transport numbers, but another method for effecting this is deduced. When, however, the numbers so obtained for chlorine in cadmium chloride are compared with those obtained by the customary Hittorf's method, they agree well for dilute, but not for concentrated, solutions; the conclusion is therefore drawn that, whereas Nernst's theory of diffusion for electrolytes is completely justified for dilute solutions, it is not applicable to concentrated solutions, and in all probability the laws governing the latter are of an essentially different character. Z. K.

Alkali Electrode. PAUL T. MULLER and H. ALLEMANDET (*J. Chim. Phys.*, 1907, **5**, 533—556).—The authors have prepared an alkali electrode consisting of mercury and yellow mercuric oxide in contact with solutions of different bases. The purification of the reagents and the arrangements employed for preventing contamination with carbon dioxide during the measurements are fully described. In order to increase the conductivity, the solution in the alkali compartment also contained potassium nitrate.

The electrode was connected with a calomel electrode, thus constituting a cell Hg | HgCl + KCl | KNO_3 + KOH + HgO | Hg, and the potential measurements carried out by the compensation method at 25°. Results are given for *N*/10 to *N*/1000 solutions of the hydroxides of potassium, sodium, lithium, thallium, barium, strontium, and calcium, and it is shown that with proper precautions the *E.F.M.*'s are reproducible to about a millivolt. In *N*/100 solution, the so-called "absolute" value of the single potential difference (calculated by means of Ostwald's value for the calomel electrode) varies only from 0·5042 to 0 5078 for the different bases, the mercury being positive, in satisfactory agreement with the view that the OH′ ion concentration alone determines the potential. At higher concentrations, the alkaline earth bases give a slightly greater *E.M.F.* than the alkali bases, indicating a less complete electrolytic dissociation in the former case, but the difference in the degree of dissociation in corresponding solutions could not be calculated from the results, owing to the uncertainty introduced by the diffusion potential at the liquid junction.

Even in the most dilute solutions there is a slight difference of potential, not much greater than the experimental error, between the *E.M.F.* of the potassium and sodium electrodes; this is ascribed to the fact that in the former case the potassium nitrate added to increase the conductivity has an ion in common with the alkali surrounding the electrode. G. S.

Nickel Peroxide Electrodes. FRITZ FOERSTER (*Zeitsch. Elektrochem.*, 1907, **13**, 414—434).—Bellucci and Clavari (Abstr., 1905, ii, 823) have shown that, in the oxidation of nickelous hydroxide, the primary product is always NiO_2. The author finds that the active mass of a nickel peroxide accumulator plate after complete discharge consists of $Ni(OH)_2$ when it is dried over sulphuric acid. The active oxygen in a fully-charged electrode was estimated by treating a portion of it with acid hydrogen peroxide and measuring the oxygen evolved, or by boiling with hydrochloric acid and estimating the chlorine produced; in this way, it was found that the oxidised mass contains from 0·53 to 0·56 atom of active oxygen to 1 atom of nickel. After washing and drying as quickly as possible over sulphuric acid, the substance had the composition $Ni_2O_3,1{\cdot}1$—$1{\cdot}3H_2O$. This is quite stable when dry, but decomposes slowly at the ordinary temperature when wet. The equilibrium potential of a charged electrode in 2·8*N*-potassium hydroxide solution diminishes, quickly at first, more slowly afterwards, to a constant value which is identical with that obtained with Ni_2O_3. Oxygen gas is evolved during this change. The decreased concentration of the potassium hydroxide in the pores of the electrode, due to the charging, would account for a higher potential at first, but it is found that a similar increase of potential at the iron electrode disappears in less than one hour, whereas twenty to thirty days are required for the peroxide electrode. The author therefore regards it as more probable that the fully-charged electrode consists of a solid solution of NiO_2 in Ni_2O_3. The evolution of oxygen which takes place from a freshly-charged electrode is due to the decomposition of the NiO_2.

The author does not agree with Zedner (Abstr., 1906, ii, 595) as to the meaning of the different portions of the discharge curve. The comparatively rapid fall of *E.M.F.* at the beginning of the discharge is regarded as due to the disappearance of the NiO_2 existing in solid solution in Ni_2O_3. The first period of approximately constant *E.M.F.* corresponds with the reduction of Ni_2O_3 to $Ni(OH)_2$, and the second period of constant *E.M.F.* (about 0·55 volt below the first) is due to an oxide lying between Ni_2O_3 and NiO. In charging the electrode, a higher *E.M.F.* is required than that observed during discharge, owing to the fact that NiO_2 is the primary product of oxidation, Ni_2O_3 being formed by its reaction with $Ni(OH)_2$, the change is therefore not strictly reversible. T. E.

[Nickel Oxide Electrode.] FRITZ FOERSTER (*Zeitsch. Elektrochem.*, 1908, **14**, 17—19).—A reply to Zedner's criticism (this vol., ii, 12); the author maintains that the behaviour of a freshly-charged nickel oxide electrode is quite inexplicable on Zedner's assumption that it contains occluded oxygen, but is in complete harmony with the view that it contains NiO_2. The actual degree of hydration of the oxides contained in the electrode in contact with the concentrated solution of potassium hydroxide cannot be determined by analysis of washed and dried samples. T. E.

Wehnelt Cathode in High Vacua. A. WEHNELT (*Physikal. Zeitsch.*, 1908, **9**, 134—135).—The author replies to Soddy (this vol., ii, 81), and maintains that he has never held the view attributed to him that the large currents attainable in spectrum tubes provided with a Wehnelt cathode are entirely due to electrons emitted by the strongly heated cathode. It is, however, claimed that currents may pass through highly exhausted tubes, in which the only carriers are the electrons emitted by the cathode, but the intensity of such currents is of a much smaller order of magnitude (10^{-2} amperes). The fact that maximum saturation currents are obtainable which are independent of the pressure, provided this is less that 0·1 mm., is evidence of such electron currents.

The part played by the electrons emitted by the hot cathode in the case of the larger ionisation currents, consists in the removal of the large fall of potential at the cathode, which results from the deficiency of electrons in consequence of the very different velocities of the positive ions and the electrons. H. M. D.

Electrical Resistance and Expansion of the Metals. WITOLD BRONIEWSKI (*J. Chim. Phys.*, 1907, **5**, 609—635. Compare Abstr., 1906, ii, 646; *J. Chim. Phys.*, 1907, **5**, 57).—In previous papers, the relation between the variation of the electrical resistance and the expansion of monatomic metals and of some polyatomic metals has been dealt with; in the present paper, the consideration of polyatomic metals is completed, and a résumé of the results is given.

The polyatomic metals are divided into two groups: (*a*) the iron group, "for which the space between the atoms is constant"; (*b*) the antimony, selenium, and gallium groups, "for which the space between the atoms is variable." The behaviour of the first group has already been considered (*loc. cit.*).

Unlike monatomic metals, the quotient of the atomic latent heat of fusion by the absolute temperature of fusion is not constant for polyatomic metals; it is 4·86 for bismuth, and 1·80 for thallium. For the second group of metals mentioned, it is shown from available data that the variation of the electric resistance with temperature is represented satisfactorily by the formula $\gamma_t = \text{const.} \times T(2F + T)$, where γ_t is the resistance at a definite temperature, T is the absolute temperature, and F is the absolute temperature of fusion, a formula which also holds for monatomic metals.

Matthiesson has shown (1863) that for a pure and impure form of the same metal the relation $\gamma R = \gamma' R'$ holds, where γ and γ' and R and R' are the temperature-coefficients and the specific resistances of the pure and impure metal respectively. The limiting specific resistances, R, for a number of pure metals are calculated from the known values of γ, γ' and R', and the results are compared with the experimental values. It is considered probable that the observed diminution of the temperature-coefficient of the resistance of palladium and platinum with temperature is due to traces of impurities, and that the pure metals, like nearly all other metals, have a positive temperature-coefficient of conductivity. G. S.

Ionisation of Liquid Dielectric Media by Radium Rays. GEORGE JAFFÉ (*Ann. Physik*, 1908, [iv], **25**, 257—284).—The electrical conductivity of light petroleum, carbon tetrachloride, carbon disulphide, and benzene is increased by exposure to radium rays. The relation between the current (i) thus produced and the *E.M.F.* (e) applied to the electrodes is: $i = f(e) + c.e$, where c is a constant. When the field strength is greater than a certain value between 500 volt/cm. and 1000 volt/cm., the term $f(e)$ is a constant, and the relation between current and potential is then a linear one. There is thus considerable analogy between the behaviour of liquid dielectric media exposed to the action of radium rays and the behaviour of ionised gases.

J. C. P.

A Relation Between Ionic Mobility and Temperature-coefficient. EWALD RASCH and F. WILLY HINRICHSEN (*Zeitsch. Elektrochem.*, 1908, **14**, 46—47).—Using the values calculated by Kohlrausch and Drucker, it is shown that the product $a_{18}.\log l_{18}$ is a constant, l_{18} and a_{18} being the mobility of an ion and its temperature-coefficient at 18°. The values of the constant calculated lie between 0·0367 and 0·0404 for the univalent ions, and between 0·0407 and 0·0434 for the bivalent ions. T. E.

Abnormal Mobility of the Ions of some Rare Earths. JULES ROUX (*Compt. rend.*, 1908, **146**, 174—175).—The mobility of the univalent ions, except hydrogen (318) and hydroxyl (174), approximates to the value 67 (Cl, 65; Rb, 68), that of the bivalent ions to 48 (Zn, 46; Ca, 51), and that of the negative tervalent ions to 85 ($\frac{1}{3}[Fe(CN)_6]$, 82; $\frac{1}{3}[Cr(CN)_6]$, 90). Hitherto, the mobilities of the positive tervalent ions have not been determined, owing to the hydrolysis of their salts. Some of the metals of the rare earths, however, form perfectly neutral solutions, and by measurement of the conductivity of solutions of lanthanum nitrate and of the bromides (prepared by Bourion's method, Abstr., 1907, ii, 773) of lanthanum, yttrium, cerium, gadolinium, and samarium at concentrations 1/100th, 1/200th, and 1/10,000th normal, the author has determined the mobility of the ions of these metals. The following values were obtained at 18° with respect to mercury at 0°. Lanthanum (in nitrate), 111 at *N*/100, 112 at *N*/200; (in bromide) 111 at *N*/100, 112·5 at *N*/200, 116 at *N*/10,000; yttrium, 115 at *N*/100, 116·5 at *N*/200; cerium, gadolinium, and samarium, 112, 91, and 66 respectively at *N*/100. Thus these ions (except that of samarium) have a greater mobility than either univalent, bivalent, or negative tervalent ions. The low value for samarium suggests the possibility of separating this metal from the others by diffusion or by electrolysis. With a rise of temperature, the mobility of the lanthanum ion in *N*/100 solutions of the nitrate increases from 111 at 18° to 131 at 25°. E. H.

A Relation Between Electrical Conductivity and Temperature. EWALD RASCH and F. WILLY HINRICHSEN (*Zeitsch. Elektrochem.*, 1908, **14**, 41—46).—An equation of the same form as van't Hoff's equation ($d\log K/dT = -q/RT^2$) expresses the connexion between the conductivity of an electrolyte and the temperature. Putting x, the conductivity, in place of K, and assuming that q is a thermal constant, the exact physical meaning of which is undefined, there is obtained, after integration, $\log x = -\gamma/T + C$, where γ and C are constants. This equation is shown to hold good for antimony trichloride (100—210°), three kinds of glass (200—350°), porcelain (50—210°), linseed oil (24—135°), water and ice (−17—50°), a mixture of zirconia and yttria (432—987°), and fused sodium chloride (800—950°). The numbers in brackets are the temperatures between which the relationship is tested. T. E.

Electrolytic Conductivity of Bromine and Iodine in Nitrobenzene Solution. LUDWIK BRUNER (*Bull. Acad. Sci. Cracow*, 1907, 731—738. Compare Bruner and Dluska, this vol., i, 146).—The results obtained in the investigation of the action of bromine on toluene in nitrobenzene solution having suggested that halogens are electrolytically dissociated in this solvent, the author has commenced the study of the conductivity of bromine and iodine in organic solvents. The present paper contains an account of the preliminary experiments. It is found that bromine and iodine in nitrobenzene solution have a marked conductivity, which varies with the time.

The cause of this variation remains unknown, but cannot be a substitution in the nucleus of the solvent, since in that case the variation would increase with the concentration, whereas it is found to be greatest in dilute solution. The value of Δ increases rapidly in concentrated solutions, the resistance being almost independent of the concentration.

Bromine does not conduct in carbon tetrachloride, nor does iodine in toluene solution. G. Y.

Conductivity of Picric Acid Solutions and the Ionic Conductivity of Hydrogen. HERBERT GORKE (*Zeitsch. physikal. Chem.*, 1908, 61, 495—502).—The conductivity of dilute solutions of picric acid has been determined with special precautions. Extrapolation of the observed values gives $\Lambda_{\infty} = 346{\cdot}4$ at 18° and $\Lambda_{\infty} = 384{\cdot}3$ at 25°. From these figures, it may be shown that picric acid does not obey Ostwald's dilution law (compare Rothmund and Drucker, Abstr., 1904, ii, 231). The conductivity of solutions of sodium picrate has also been measured, and the conductivity of the picrate ion is found to be 26·0 and 30·7 at 18° and 25° respectively. Hence the ionic conductivity of hydrogen is 320 at 18° and 353 at 25°, and the temperature-coefficient is 0·0148 (compare Kohlrausch's value 0·0153). These values for the ionic conductivity of hydrogen are higher than those given by Kohlrausch and by Ostwald and Luther. The author himself regards them as possibly 1% too low; even allowing for this, they would still be lower than the values which are deduced from Noyes and Sammet's work (Abstr., 1903, ii, 126). J. C. P.

The Existence of Positive Electrons in the Sodium Atom. ROBERT W. WOOD (*Phil. Mag.*, 1908, [vi], 15, 274—279; *Physikal. Zeitsch.*, 1908, 9, 124).—Plane polarised white light is passed through sodium vapour, unmixed with any other gas, and placed in a strong magnetic field parallel to the direction of the light. Before exciting the magnet, a Nicol prism is placed so as to extinguish the light which has passed the sodium vapour. When the magnet is excited, a large number of bright lines become visible when the light which now passes the second Nicol is examined spectroscopically. The author has succeeded in showing that in some of these lines the plane of polarisation has been rotated to the right, and in others to the left. Since the direction in which the plane of polarisation is rotated by the *D* lines indicates that they are due to the vibration of negative electrons, the opposite rotation observed in some of the lines would indicate the existence of positive electrons in the sodium atom.

T. E.

Difference of Potential in the Arc Produced by a Continuous Current between Metallic Electrodes. CHARLES E. GUYE and L. ZEBRIKOFF (*Arch. Sci. phys. nat.*, 1907, [iv], 24, 549—574).—The formula deduced by Mrs. Ayrton for the relation between the length of the arc, the difference of potential, and the intensity of the current was verified by her when carbon poles were used. The authors find that this formula is applicable also when the poles consist of gold, platinum, silver, palladium, copper, cobalt, nickel, or iron.

J. C. P.

Electric Discharge in Monatomic Gases. Frederick Soddy and Thomas D. Mackenzie (*Proc. Roy. Soc.*, 1908, **80**, *A*, 92—109).—The high resistance offered to the electric discharge in spectrum tubes containing monatomic gases has been studied. For this purpose, the conditions of the discharge through helium, argon, neon, mercury, hydrogen, nitrogen, and carbon dioxide have been compared. Non-conductance equivalent to that represented by an inch gap in air at atmospheric pressure was attained at the following pressures: helium 0·35 mm., argon 0·04 mm., neon 0·07 mm., hydrogen 0·03 to 0·04 mm., nitrogen 0·035 mm., carbon dioxide 0·02 mm. of mercury. With a spark gap of 10 mm., mercury vapour was found to conduct with difficulty at a pressure of 0·1 mm., and thus resembles helium in regard to the high pressure at which it ceases to be conducting. The results obtained indicate that the difference between helium and other gases is one of degree only, and that the monatomic gases are relatively inert, electrically as well as chemically. To explain the observed facts, it is only necessary to assume that the helium molecule is at all pressures only about one-fifth to one-tenth as effective electrically as a molecule of hydrogen. This view has been confirmed by determining the relation of the potential to the pressure in helium, argon, and hydrogen at high pressures. Some observations relating to the Campbell Swinton effect indicate that the bubbles formed when the glass of a discharge tube is fused are due to chemical decomposition of the glass under the influence of the local heating, which takes place in the course of the bombardment of the glass by the enclosed gas particles.

H. M. D.

Certain Phenomena Exhibited by Small Particles on a Nernst Glower. C. E. Mendenhall and L. R. Ingersoll (*Phil. Mag.*, 1908, [vi], **15**, 205—214).—Small globules (0·1 to 0·2 mm. diameter) of molten metals may be supercooled as much as 370° (rhodium and platinum). Gold, palladium, silicon, and iridium behave similarly. A flash, due to liberation of the latent heat, occurs at the moment of solidification. A reversible change in radiating power occurs in rhodium at 1050°. Small globules of molten metals slide or roll along a Nernst glower, and solid particles roll end over end. Boron, rhodium, palladium, silver, barium oxide, columbium oxide, iridium, platinum, and gold move with the current, and magnesium oxide, silicon, titanium, chromium, manganese, iron oxide, cobalt, nickel, copper, and ruthenium against it. The rate of motion varies widely with the nature of the particle, cobalt and copper giving the fastest motion; it also increases with the current flowing, and to a less extent with the temperature. Carbon dioxide, oxygen, or a vacuum do not affect the motion. It does not occur on metallic conductors. No satisfactory explanation of the motion has been found.

T. E.

Magnetic Behaviour of Air, Argon, and Helium in Relation to Oxygen. Paul Tänzler (*Ann. Physik*, 1907, [iv], **24**, 931—938).—Whilst air and oxygen are paramagnetic, argon and helium are diamagnetic. J. C. P.

Decomposition of Complex Chemical Compounds in a Variable Magnetic Field. J. Rosenthal (*Sitzungsber. k. Akad. Wiss. Berlin*, 1908, 20—26).—Evidence has been obtained that complex organic compounds are decomposed when subjected to the action of varying electromagnetic forces. The substances examined, dissolved or suspended in water, were brought into a solenoid, through the coils of which intermittent or alternating currents were passed. For the success of the experiment, the frequency of intermittence or alternation must have a definite value which depends on the nature of the substance examined. With the requisite frequency, the heat developed in the liquid is very much smaller than when other frequencies are employed, and the author supposes that, in the first case, the energy is chiefly used up in bringing about the decomposition of the complex molecules, whilst with unfavourable frequencies rise of temperature is the only result. For starch, the effective frequencies lie between 440 and 480 oscillations per second, and for proteins the number is 320—360, whilst other substances examined (glucosides, disaccharoses) require very much higher frequencies. The decomposition of starch takes place in stages, the succession of products being the same as those found in the action of diastatic enzymes. Proteins give rise to albumoses and peptones. The analogy between the action of the electromagnetic forces and that of enzymes is regarded as important from the standpoint of the general theory of enzyme action. H. M. D.

Zeeman Phenomenon. W. Lohmann (*Zeitsch. Photochem.*, 1908, **6**, 1—24, 41—60).—By means of an echelon diffraction grating, the Zeeman phenomenon has been investigated for the chief spectral lines of sodium, mercury, helium, neon, and krypton. Observations were made parallel and at right angles to the magnetic lines of force, and the gradual resolution of the spectral lines with increasing intensity of the magnetic field was traced by observations in fields varying from about 2000 to 15,000 Gauss. Here it may be noted that the extent to which the component lines are separated is proportional to the strength of the magnetic field. The differences in the Zeeman effect, which are observable with the different spectral lines, indicate that these are to be ascribed to atoms of unlike structure.

H. M. D.

Expansion of Commercial Pentane and the Scale of the Pentane Thermometer. Friedrich Hoffmann and Rudolf Rothe (*Chem. Zentr.*, 1907, ii, 1369—1370; from *Zeitsch. Instrumentenkunde*, 1907, **27**, 265—271).—The expansion of commercial pentane has been calculated previously from observations at three fixed points with the aid of a quadratic interpolation formula. The authors' determinations show that the error of pentane thermometers standardised in this manner may amount to 2°. It is necessary to determine the expansion at least at four points. In the method employed, two dilatometers filled with pentane are compared with a platinum resistance thermometer. A thermostat, cooled by liquid air and electrically heated, for use at temperatures between $-190°$ and $-130°$ is described. The expansion at t^0 is represented by the expression: $A_t = 10^{-6}t(1506{\cdot}97 + 3{\cdot}453_5 t + 0{\cdot}0097_5 t^2 - 0{\cdot}00001 t^3)$. The corrections to be applied to the old pentane thermometer at different temperatures are given in a table. The b. p. of oxygen as observed by Grunmach (Abstr., 1906, ii, 655), when corrected for the error of the pentane thermometer, for the pressure, and for the presence of 2% of nitrogen, is $-182{\cdot}66°/760$ mm., which is in agreement with the observations of other investigators. G. Y.

Measurement of the Velocity of Sound in Liquids and of the Ratio of the Two Specific Heats of Ether with the Help of Kundt's Dust Figures. Karl Dörsing (*Ann. Physik*, 1908, [iv], **25**, 227—251).—The liquids examined were water, alcohol, ether, strong ammonia solution, concentrated hydrochloric acid, sodium chloride solutions, chloroform, carbon disulphide, turpentine, and "benzin."

With rising temperature, the velocity of sound in water increases, whilst the velocity in other liquids diminishes. In liquids which contain either dissolved gases or salts, the velocity of sound increases with the amount of the dissolved gas or salt. The ratio of the two specific heats for ether at 15° is 1·376.

It should be noted that in order to obtain dust figures in liquids, the vibration of the liquid column must be in harmony with that of the containing tube. The dust employed by the author was powdered pumice stone. J. C. P.

A New Method of Determining the Melting Point of Metals. Iwan I. Shukoff and W. J. Kurbatoff (*J. Russ. Phys. Chim. Soc.*, 1907, **39**, 1546—1548).—A similar apparatus has been described by Loebe (Abstr., 1907, ii, 735), but the authors claim priority. Z. K.

Internal Friction and Density of the Bunsen Flame. August Becker (*Ann. Physik*, 1907, [iv], **24**, 823—862).—Measurements have been made of the extent to which small solid spheres are buoyed up at various points in the interior of a bunsen flame, and in currents of different gases moving with known velocity. From these observations, it appears that the variation of the internal friction from point to point of the bunsen flame is similar to that detected by Bunsen for the thermal and chemical action, and by Lenard for the emissivity. From the variation of the internal friction, it is possible to make an estimate of the composition of the gaseous mixture at different points in the flame. J. C. P.

Curves of Instantaneous Heat Power determined from Chemical Reactions. Aldo Mieli (*Gazzetta*, 1907, **37**, ii, 636—647).—The heat power of a constant source of heat is defined as the quantity of heat, either positive or negative, developed per unit of time. With a variable heat source, the notion of an instantaneous heat power must be employed. The author deduces theoretically the time curves of instantaneous heat power for different chemical reactions.

For a simple isothermal reaction, this curve is homologous with that expressing the velocity of the reaction. The same is the case with reversible or lateral reactions, but with polygrade reactions the two curves are not homologous. Similar relations hold for these various types of reactions when the latter take place adiabatically.

The general case, in which a reacting system is exchanging heat with its surroundings, but is not at constant temperature, is also considered. T. H. P.

Calorimetric Method Applied to the Study of Slow Reactions. JACQUES DUCLAUX (*Compt. rend.*, 1908, **146**, 120—123).—The corrections, which must be applied to the numbers observed in the calorimetric study of a reaction, and become large and uncertain when the reaction is a slow one, can be reduced to very small quantities by using as a calorimeter a Dewar tube provided with a cork and immersed completely in the water of a thermostat, and by ensuring that initially the tube and liquids studied have the same temperature as the thermostat. For a tube containing 35 c.c. of liquid and having an excess temperature of 1° after one minute duration, the correction is only 0·002°, and the method has the very great advantage that this correction can be determined once for all with an approximation of at least 1 in 20. The volume of air above the liquid being small, no correction is necessary for evaporation, and the rise of temperature being slow, the lag of the thermometer causes an inappreciable error. The only difficulty, arising when it is required to measure absolute quantities of heat, consists of the determination of the water-equivalent of the calorimetric tube, which may amount to 20% of the whole heat value. It can be determined either from the dimensions of the tube, or by comparative experiments with substances developing a known quantity of heat.

Besides being used for thermochemical measurements, the method has a very important application in the study of diastatic reactions of all kinds. By its means, the course of a reaction can be followed, since, in the absence of any complication due to a secondary reaction, the quantity of matter transformed in dilute solutions is proportional to the rise of temperature, continued observations of which will therefore lead to the determination of the law of the transformation. The method has been successfully applied to the catalysis of hydrogen peroxide solutions by ferric hydroxide, the inversion of sucrose, and the saponification of ethyl and amyl acetates. The degree of accuracy obtained when using a thermometer reading to 0·02° is two to four times less than the ordinary titrimetric or polarimetric methods, but it could be increased at the expense of simplicity by using an electrical thermometer. The method has the advantage of being applicable to any liquid whatever at any temperature below 100°, the only condition essential being that an appreciable quantity of heat is developed. E. H.

Determination of the Heat of Combustion of Organic Compounds by Use of the Platinum Resistance Thermometer. EMIL FISCHER and FRANZ WREDE (*Sitzungsber. k. Akad. Wiss. Berlin*, 1908, 129—146).—By substituting a platinum resistance thermometer for the mercury thermometer commonly used, the accuracy with which the heat capacity of the bomb, stirrer, &c., can be determined is considerably increased. The estimated maximum possible error in the calibration of the apparatus used by the authors is 0·05%.

For the purpose of obtaining standard values which may be used in the calibration of other calorimetric bombs, the heats of combustion of sucrose and benzoic acid have been carefully determined. The calculated heats of combustion for 1 gram of substance (weighed in vacuum) are for sucrose 16·545, for benzoic acid 26·475, kilowatt seconds. Assuming that 1 kilowatt second = 0·2390 Cal., the numbers are respectively 3·954 and 6·328 Cal. H. M. D.

Heat of Formation of Anhydrous Barium and Strontium Oxides. ROBERT DE FORCRAND (*Compt. rend.*, 1908, **146**, 217—220). —Pure anhydrous barium and strontium oxides can be obtained in the form of colourless powders by heating the corresponding hydroxide in a current of dry hydrogen at 800—850° (Abstr., 1907, ii, 683, 928). The heats of solution of these oxides, calculated from their heats of solution in dilute hydrochloric acid, are for 1 gram-molecule of SrO in 20 litres and 1 gram-molecule of BaO in 12 litres of water at 15°, 30·8 Cal. and 35·640 Cal. respectively. The discrepancies between these values and those obtained by Thomsen (29·34 Cal. and 34·52 Cal.) are probably due to the impurities which are always present in alkali-earth oxides obtained by ignition of the nitrates. The heat of formation of the oxide of calcium, lithium, strontium, or barium, calculated from the heat of solution of the oxide (Abstr., 1907, ii, 683, 928) and of the metal (Guntz, Abstr., 1903, ii, 410; 1905, ii, 300; 1906, ii, 229), is 151·90, 143·32, 137·60, or 125·86 Cal. respectively, and the corresponding values for the peroxides of the metals are 157·33, 152·65, 152·10, and 145·71 Cal. respectively. The author draws attention to the close approximation between the thermochemical constants of strontium and lithium (compare Wyrouboff, Abstr., 1897, ii, 173). M. A. W.

Heats of Dissolution of the Alkali Metals, and the Heats of Formation of their Protoxides. ÉTIENNE RENGADE (*Compt. rend.*, 1908, **146**, 129—131. Compare Abstr., 1907, ii, 737).—Owing to the explosive violence with which rubidium and cæsium react with water, Joannis' apparatus (Abstr., 1888, 1238) cannot be used to determine their heats of solution. The author has employed, instead, a modification of Mahler's calorimetric bomb, of which a diagram and description are given. By means of this apparatus, the heats of dissolution of sodium, potassium, rubidium, cæsium, and their protoxides were measured. The sodium used contained less than 0·1% of potassium, the potassium was re-distilled in a vacuum from the commercial metal, and the rubidium and cæsium were prepared from the pure chlorides.

The following are the mean values obtained from a concordant series of experiments: (1) (Na,Aq) = 44·1 Cal., (K,Aq) = 46·4 Cal., (Rb,Aq) = 47·25 Cal., (Cs,Aq) = 48·45 Cal.; (2) (Na_2O,Aq) = 56·5 Cal., (K_2O,Aq) = 75·0 Cal., (Rb_2O,Aq) = 80·0 Cal., (Cs_2O,Aq) = 83·2 Cal.

The heats of dissolution of rubidium and cæsium are lower than the values 48·2 and 51·6 given by Beketoff, whilst the values for sodium and potassium are slightly higher than those of Joannis. The numbers obtained for the heats of dissolution of rubidium and cæsium oxides differ from those previously found by the author. The discrepancy in the case of the former oxide may be due to the fact that rubidium oxide gradually decomposes on exposure to light with liberation of the metal.

From the series (1) and (2), the following values are calculated: (Na_2,O) = 100·7 Cal., (K_2,O) = 86·8 Cal., (Rb_2,O) = 83·5 Cal., (Cs_2,O) = 82·7 Cal., for the heats of formation of the oxides. Both series of numbers indicate a perfectly regular variation in the thermal properties of the alkali metals with increasing atomic weight. The anomalous value for cæsium obtained by using Beketoff's value for the heat of dissolution of the metal is no longer observed, and the alkali metals are now shown to follow the general rule of decreasing affinity for oxygen with increasing atomic weight. E. H.

Densities of Some Fused Salts and their Mixtures at Various Temperatures. RICHARD LORENZ, H. FREI, and A. JABS (*Zeitsch. physikal. Chem.*, 1908, **61**, 468—474).—The method employed was essentially that described by Brunner (Abstr., 1904, ii, 244).

The results obtained for the densities of the pure fused salts may in all cases be represented by a formula of the type $\gamma = a + bt$, where γ is the weight of 1 c.c., t is the temperature on the centigrade scale, and a and b are constants. The formulæ for the various salts are as follows: potassium nitrate (m. p. 329°), $\gamma = 2·044 - 0·0006t$; sodium nitrate (m. p. 310°), $\gamma = 2·12 - 0·0007t$; lead chloride (m. p. 512°), $\gamma = 5·627 - 0·00144t$; lead bromide, $\gamma = 6·175 - 0·00145t$; cadmium chloride, $\gamma = 3·731 - 0·000685t$; potassium bromide, $\gamma = 2·626 - 0·00081t$. In the case of sodium chloride, potassium chloride, and sodium bromide, the authors' results are represented satisfactorily by Brunner's formulæ (*loc. cit.*).

Densities at various temperatures and various concentrations have also been determined for the following pairs of salts: lead and potassium chlorides; lead and barium chlorides; lead and potassium bromides; cadmium and potassium chlorides. The variation of density with temperature and concentration may be represented by the formula $\gamma = a - b.t + c.Nt + d.N$, where N is the molecular proportion of one constituent, $1 - N$ the molecular proportion of the other, and a, b, c, and d are constants. J. C. P.

A Simple Form of Release for Victor Meyer's Vapour-Density Apparatus. THOMAS S. PATTERSON (*Chem. News*, 1908, **98**, 73).—A device which enables the little tube containing the weighed quantity of substance to be introduced into the apparatus in a vertical position.

A cork diaphragm, with an eccentrically-bored hole, is fitted at the base of the wide part of the neck. The cork closing the apparatus has a hole bored in a slanting direction, through which a glass tube passes. The tube of substance is dropped into this, and by rotating the cork it is allowed to fall through the hole in the diaphragm.

P. H.

New Method Suggested for Determining Vapour Densities. II. Philip Blackman (*Chem. News*, 1908, **97**, 27. Compare Abstr., 1907, ii, 931).—The apparatus previously described has been simplified. In the new form, the manometer consists of a capillary U-tube, one end of which is sealed, and the other closed by a short thread of mercury. The U-tube is placed in the glass cylinder, the stopper at the lower end being made tight by pouring in a little mercury.

H. M. D.

An Apparent Exception to the Theory of Heterogeneous Dissociation Equilibria. Richard Abegg (*Zeitsch. physikal. Chem.*, 1908, **61**, 455—456).—Attention is directed to Baker's observations (Trans., 1894, **65**, 611; 1898, **73**, 422), according to which perfectly dry ammonium chloride vaporises without dissociation. From these and other experiments, it appears in fact that ammonium chloride, when vaporised, exerts about 1 atmosphere pressure at 360°, whether it is dissociated or undissociated. In the first case, the partial pressure of the undissociated molecules is very small; in the second case, it is about 1 atmosphere. This result is inconsistent with the theory of heterogeneous equilibria, according to which the concentration of the undissociated vapour should, at a given temperature, be independent of the presence of other gases, including the dissociation products. With the view of finding whether this inconsistency is real or apparent, the subject has been treated experimentally by Johnson (see following abstract).

J. C. P.

Vapour Pressure of Dry Sal Ammoniac. Frederick M. G. Johnson (*Zeitsch. physikal. Chem.*, 1908, **61**, 457—463. Compare Abegg, preceding abstract).—An apparatus is described, made entirely of glass, in which ammonium chloride could be dried perfectly and examined (1) as regards vapour pressure, and (2) as regards vapour density. The pressure was measured with the help of a flat, spiral glass tube, which acted as a manometer (see Ladenburg and Lehmann, *Verh. physikal. Ges.*, 1906, **8**, 20).

The author confirms Baker's results, and finds that the density of perfectly dry ammonium chloride at 345° is that of the undissociated compound. The vapour pressures at various temperatures of this specially dried ammonium chloride and also of the ordinary ammonium chloride have been determined, and it is found that the vapour pressure of the undissociated salt in the one case is equal to the sum of the vapour pressures of the dissociation products in the other case. The result is not in harmony with the theory of heterogeneous dissociation equilibria, but no simple explanation of this can be suggested.

J. C. P.

Relationships between Compressibility, Surface Tension, and other Properties of Substances. Theodore W. Richards and J. Howard Mathews (*Zeitsch. physikal. Chem.*, 1908, **61**, 449—454. Compare Ritzel, Abstr., 1907, ii, 740).—In this preliminary communication, the authors record values for the compressibility, boiling point, density, surface tension, vapour tension at 20°, and molecular latent heat of vaporisation for thirty-seven organic liquids. The compressibility (β) and the surface tension (γ) are found to be connected by the following equation: $\beta\gamma^{4/3} = \text{const.} = 2{\cdot}5 \times 10^{-8}$, which is valid for all the liquids examined, except four halogen compounds. The fact that substances with a high surface tension are only slightly compressible is discussed from the point of view of the theory that the atoms are compressible. It is pointed out that compressibility must depend, not only on the volume changes resulting from the alteration of the molecular distances, but also on the internal changes of the molecules. J. C. P.

Surface Tension of Liquids Investigated by the Method of Jet Vibration. P. O. Pedersen (*Proc. Roy. Soc.*, 1907, **80**, *A*, 26—27).—Lord Rayleigh showed many years ago (*ibid.*, 1879, **29**, 71) that the surface tension of a liquid could be calculated from observations on a vibrating jet when the length of the standing waves, the velocity and cross-section of the jet, and the density of the liquid are known. The author has worked out methods for determining these magnitudes, and has obtained very consistent results for the surface tension.

The surface tension of water, toluene, and aniline are 74·30, 28·76, and 43·00 dynes/cm. at 15°. Some measurements have also been made with aqueous solutions. G. S.

Decolorising Action of Charcoal. Leopold Rosenthaler (*Arch. Pharm.*, 1907, **245**, 686—689).—A reply to certain criticisms made by Glassner and Suida (Abstr., 1907, ii, 932) on a paper by Rosenthaler and Türk (Abstr., 1907, ii, 12). The former authors did not observe that charcoal adsorbs relatively much more strongly from dilute than from concentrated solutions, because they used dyes. In the case of dyes, various chemical complications disturb the purely physical phenomena of adsorption. Rosenthaler and Türk, on the other hand, worked with caffeine and with dextrose, and were thus able to observe the great effect of the concentration of the solution. G. B.

Velocity of Absorption of Gaseous by Solid Substances. Arthur Hantzsch and G. Wiegner (*Zeitsch. physikal. Chem.*, 1908, **61**, 475—490).—Re-examination of the experimental basis of a previous paper (Abstr., 1904, ii, 541) shows that the conclusions then reached must be modified. The absorption of ammonia by solid acids and of hydrogen chloride by solid bases does under certain conditions take place in approximate accord with the formula for a unimolecular reaction, but it is not possible to draw any trustworthy conclusions as to the magnitude of the affinity constant of the acid or base from the magnitude of the absorption constant. The absorption of ammonia or hydrogen chloride in a diluted condition takes place according to the formula for a bimolecular reaction only in a limited number of cases. Difference in the rate of absorption cannot be employed as a means of distinguishing true acids from pseudo-acids, or true bases from pseudobases. J. C. P.

Absorption of Gases by Rubber Tubing. RUDOLF DITMAR (*Chem. Zentr.*, 1907, ii, 1578—1579; from *The India Rubber Journal*, **34**, 85—86, 197—198).—An arrangement is described for measuring the pressure of a gas in a rubber tube, jacketed with the same or with another gas In experiments with a tube of red rubber of unknown composition, air is found to exert pressure when the tube is surrounded by air. Carbon dioxide, on the other hand, is absorbed by the rubber tube when the jacket is air, or to a smaller extent when the jacket is hydrogen, whilst hydrogen is absorbed, although to a smaller extent than carbon dioxide, when the tube is surrounded by air or carbon dioxide, but exerts pressure when the tube is jacketed with hydrogen. The absorption of carbon dioxide by a tube of Para rubber is found to be the same whether the atmosphere surrounding the tube is carbon dioxide or air. G. Y.

[Diffusion of Metals in Mercury.] G. MCPHAIL SMITH (*Ann. Physik*, 1908, [iv], **25**, 252—256).—The author criticises Wogau's view (Abstr., 1907, ii, 606) that certain metals, when dissolved in mercury, are in the monatomic condition, and suggests that in many cases, at least, compounds of mercury and the dissolved metal are formed (compare Haber, Abstr., 1902, ii, 638; Smith, Abstr., 1906, ii, 673; 1907, ii, 463). It is pointed out that when Wogau's values for the diffusion constants of the metals are divided by the corresponding atomic weights, and the figures so obtained are plotted against the atomic weight, two curves result; on one of these lie the figures for Li, Na, K, Ca, Rb, Sr, Cs, Ba, and Tl, the metals which form compounds with mercury; on the other, lie the figures for Zn, Cd, Sn, and Pb, the metals which do not combine with mercury. J. C. P.

Organic Solvent and Ionising Media. X. Solvent Power and Dielectric Constant. PAUL WALDEN (*Zeitsch. physikal. Chem.*, 1908, **61**, 633—639. Compare Abstr., 1904, ii, 227; 1906, ii, 149, 335, 336, 527; 1907, ii, 231, 437, 519, 734).—The variation in the solubility of tetraethylammonium iodide in water and a number of organic liquids is recorded. For the purpose of this paper, the solubility (s) is expressed as molecular percentage of the salt in the saturated solution, that is, if the saturated solution contains n molecules of tetraethylammonium iodide for every N molecules of solvent, then $s = 100n/(n+N)$.

It is found that the solvent power for tetraethylammonium iodide falls off as the dielectric constant of the solvent diminishes; in fact, $s^{\frac{1}{3}}$ is very nearly proportional to the dielectric constant. An analogous result is obtained with tetrapropylammonium iodide as solute.

J. C. P.

Solutions in Mixtures of Alcohol and Water. Ernst Cuno (*Ber. Deut. physikal. Ges.*, 1907, 5, 735—738; *Ann. Physik*, 1908, [iv], 25, 346—376).—The author has determined the composition of the two layers which are formed when varying quantities of potassium carbonate or manganese sulphate are dissolved in mixtures of alcohol and water. In the case of both salts, alteration of temperature has only a very slight effect on the composition of the two layers. The expressions suggested by Bodländer (Abstr., 1891, ii, 794) and by Herz and Knoch (Abstr., 1905, ii, 709) are fairly constant for medium alcohol concentrations.

The conductivity of potassium carbonate and manganese sulphate in mixtures of alcohol and water has also been studied. For a given quantity of salt, the conductivity rapidly diminishes as the concentration of the alcohol increases. Increase in the proportion of alcohol leads also to a displacement of the maximum conductivity in the direction of solutions containing less salt. J. C. P.

Crystallisation from Aqueous Solutions. Robert Marc (*Zeitsch. physikal. Chem.*, 1908, 61, 385—398).—It is suggested that there is a rate of crystallisation from a supersaturated solution quite distinct from a diffusion velocity. This view is supported by experiments on the rate of crystallisation of potassium sulphate from supersaturated solutions at 0°. A quantity of fine crystals was introduced into a supersaturated solution, the solution was vigorously stirred, and the process of crystallisation was followed by taking out samples of the solution from time to time and analysing. The quantity of crystals introduced at the beginning of the experiment was three to five times the quantity which separated during the crystallisation. The surface of the crystals may be taken as proportional to $(W)^{\frac{2}{3}}$, where W is the weight of crystals present, and the rate of crystallisation is approximately proportional to the surface of the crystals calculated in this way.

It appears that the crystallisation proceeds according to the formula for a bimolecular reaction, and that the temperature-coefficient is about 1·6 for an interval of 10°. The theoretical interpretation of these results is postponed until more experimental material is available. J. C. P.

Action of Some Electrolytes on Colloidal Silver Solutions. The Process of Coagulation. H. W. Woudstra (*Zeitsch. physikal. Chem.*, 1908, 61, 607—632).—The various solutions of colloidal silver employed by the author were prepared by the methods of Muthmann, Carey Lea, and Bredig. The colloidal silver prepared by Muthmann's method resembles that prepared by the other methods, in being electronegative and in promoting the decomposition of hydrogen peroxide.

The procedure adopted in studying the coagulative power of different salts was to find in each case which, of a number of solutions of gradually diminishing concentration, was just unable to produce turbidity on addition of a given quantity of colloidal silver solution. The concentration of this particular salt solution is described as the "limiting concentration" for that salt.

The coagulation is accompanied by peculiar colour effects, the nature of the colour depending apparently on the anion of the salt. Chlorides (except lead chloride) give a bluish-white opalescence, resembling silver chloride. Coagulation by lead chloride and by sulphates is accompanied by a red coloration.

The power of salts to coagulate colloidal silver solutions depends almost entirely on the cation, and increases with the valency of the cation (compare Whetham, Abstr., 1900, ii, 62). For a given salt, the "limiting concentration" diminishes (1) with the age of the colloidal solution on which it is allowed to act, and (2) with increasing concentration of the colloidal solution.

The author discusses the various theories of coagulation which have recently been brought forward, and concludes that the formation of large aggregates from the fine colloidal particles is to be attributed to the electrical action of the ions. His experiments are in general harmony with Whetham's views (*loc. cit.*). J. C. P.

The Process of Gelatinisation. III. S. A. LEVITES (*Zeitsch. Chem. Ind. Kolloide*, 1908, 2, 208—215. Compare Abstr., 1902, ii, 312; 1903, ii, 641).—The transition from the colloidal to the gelatinised condition can be conveniently followed by measurement of the viscosity. With this object in view, the influence of concentration, of temperature, and of foreign substances on the viscosity of colloidal solutions has been examined.

For concentrated colloidal solutions, the viscosity η is approximately represented by the exponential formula $\eta = A^x$, where A is a constant, and x the concentration of the dissolved colloid. For dilute solutions, closer agreement with the experimental data is obtained by means of the linear expression $\eta = 1 + a.x$, in which a is a constant.

Lowering of temperature increases the viscosity, but for a given solution there exists a certain temperature minimum below which the viscosity gradually increases with time according to a linear equation.

Foreign substances (crystalloids), which increase the viscosity of water, increase the viscosity of colloidal solutions, and a similar relationship holds for crystalloids, which diminish the viscosity of water. This does not hold if two or more crystalloids are added to the colloidal solution, or if the crystalloid reacts chemically with the dissolved colloid. H. M. D.

Non-miscibility and the Mass Law. WILDER D. BANCROFT (*J. Physical Chem.*, 1908, 12, 30—35).—A theoretical discussion of the deviation of a reversible change $A + B \rightleftarrows AB$ from the simple equilibrium equation $yz = Kx$, which may be expected when the two components A and B are not completely miscible in the pure condition. Such a system is exemplified in chloral + water $\rightleftarrows$ chloral hydrate. The author argues that the non-miscible components A and B will render each other less soluble in the compound AB, and hence increase one another's chemical potential (compare McIntosh, Abstr., 1898, ii, 65). The result will be a forcing back of the actual percentage dissociation of AB. The degree to which the chemical potentials

of A and B would be affected is not known, but the author considers the effect on the equilibrium in several hypothetical cases.
R. J. C.

Equilibria in Ternary Systems; Additive Products of Aromatic Nitro-derivatives and Mercuric Chloride. LUIGI MASCARELLI (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 29—39. Compare Abstr., 1907, i, 25).—The author has investigated the equilibria in the systems *p*-nitrotoluene and mercuric chloride, *p*-nitroanisole and mercuric chloride, and *a*-nitronaphthalene and mercuric chloride, using ethylurethane as third substance (compare this vol., ii, 94). The results are in complete accord with the theoretical deductions concerning equilibria in ternary systems (*loc. cit.*). The double salts which these aromatic nitro-derivatives form with mercuric chloride have the same composition as the corresponding double salts formed by iodoxy-derivatives with mercuric chloride, and it is probable that similar relations exist between the corresponding mercuric bromide double compounds.
T. H. P.

Attempt to Measure the Rate of Neutralisation at Low Temperatures. RICHARD ABEGG and J. NEUSTADT (*Zeitsch. Elektrochem.*, 1908, **14**, 2—3).—Alcoholic solutions of hydrochloric acid and lithium hydroxide were mixed at −80°, but neutralisation was completed in the time required to mix the solutions. At −100°, the reaction did not appear to be quite complete thirty and forty seconds after mixing, but one minute later it was complete. The conductivity of the solutions was used to follow the progress of the change. Alcoholic solutions are too viscous at temperatures below −100° to permit of rapid mixing.
T. E.

Reaction Velocity in Gases which are in a State of Motion. MAX BODENSTEIN and KARL WOLGAST (*Zeitsch. physikal. Chem.*, 1908, **61**, 422—436).—It is incorrect to assume always that when a mixture of reactive gases passes through a vessel kept at a constant temperature their concentration diminishes uniformly from the entrance to the exit of the tube. If the temperature is such that the gases react slowly, if the vessel is not very narrow in proportion to its width, and if the rate of passage of the gases is not too great, then thorough mixing will occur, the composition of the gaseous mixture will be the same throughout the tube, and the same as that of the issuing mixture. Formulæ applicable to these conditions are developed, and they differ from the formulæ usually employed. Thus, for a unimolecular reaction, X, the absolute amount of the product formed will be proportional to the duration T of the experiment, to the volume v of the reaction vessel, and to the concentration $\frac{A-X}{V}$ of the substance which is undergoing change: hence $k=1/T.V/v.X/(A-X)$. The formula which is similarly deduced for a bimolecular reaction is $k=1/T.V^2/v.X/(A-X)(B-X)$.

The validity of the latter formula was tested by experiments on the rate of combination of hydrogen and iodine. Mixtures of hydrogen and iodine, with hydrogen in large excess, were passed through tubes heated to constant temperatures (406°, 430°, 440°), and the issuing mixtures were analysed. At these temperatures, the reaction between hydrogen and iodine is slow, so that, if the gases are not passed too rapidly, the conditions are fulfilled on which the foregoing formulæ are based. The results are in satisfactory accord with the formulæ, and values are obtained for the velocity constant of the reaction $H_2 + I_2 = 2HI$, which agree well with those deduced from the experiments made in closed vessels (Abstr., 1899, ii, 637).

Jellinek's experiments (Abstr., 1906, ii, 437) are considered from the authors' point of view, and the velocity coefficients calculated by their formula vary less than those calculated in the usual way.

J. C. P.

Urazoles. XII. Velocity Constants and Mechanism of the Reactions of Alkyl Halides with Urazoles and Urazole Salts.

Salomon F. Acree and G. H. Shadinger (*Amer. Chem. J.*, 1908, 39, 226—227. Compare this vol., i, 224).—An investigation is being carried out with the object of elucidating the mechanism of the reactions which take place between alkyl salts and other substances, such as hydroxides, carbonates, nitrates, and urazoles. The present paper deals with the velocity of the reactions of alkyl halides with 3-thio-1-phenylurazole and its metallic salts, sodium thioacetate, and potassium hydroxide. The rate of change of the urazole into its disulphide and the rate of hydrolysis of methyl iodide in 50% alcohol have also been determined. The reaction between sodium 3-thio-1-phenylurazole and ethyl iodide was followed by conductivity measurements, and evidence was obtained that ethyl iodide does not unite to an appreciable extent with the sodium or urazole ions.

The results of the work lead to the following conclusions. In the reactions of alkyl halides with urazoles, hydroxides, carbonates, and thioacetates, the alkyl halide reacts with the anion of the other compound, thus:

$$C_2H_5I + \overline{OH} \longrightarrow C_2H_5{\cdot}OH + \overline{I} \text{ or } dx/dt = K_{trans} \times C_{EtI} \times C_{OH}.$$

The hypothesis of Bruyn and Steger (Abstr., 1899, i, 849) that alkyl halides react with other substances by dissociation into alkyl and halogen ions and subsequent union of the alkyl ion with the anion, Nef's view that the reaction is due to the dissociation of the alkyl halide into the corresponding halogen acid and an unsaturated methylene complex which reacts with other substances, and Euler's hypothesis (Abstr., 1906, i, 789) that the reaction is due to the formation of a complex cation and its subsequent reaction with the anion are discussed and shown not to be in harmony with the evidence now obtained.

The alkyl halide molecules react with the anion of the substance which is being alkylated, probably forming an intermediate unstable complex anion, $C_2H_5I{\cdot}\overline{X}$, which immediately yields halogen ions and C_2H_5X.

Alkyl iodides react more readily with the urazoles than do alkyl bromides, and the bromides more readily than the chlorides. Primary alkyl halides are more reactive than secondary alkyl halides towards urazoles, and the latter more so than the tertiary compounds. This may be partly due to the so-called space interference. E. G.

Hydrolysis of Salts. AUGUSTE ROSENSTIEHL (*Bull. Soc. chim.*, 1908, [iv], 3, 86—89).—The author has shown in a former paper (Abstr., 1907, ii, 610) that all salts of which the aqueous solutions obey Berthollet's laws are completely hydrolysed in solution, and the present paper is confined to a discussion of the cases in which both the bases and acid formed on hydrolysis are soluble in water and do not readily reveal themselves. The experimental evidence is that supplied by H. Rose (*Ann. Phys. Chem.*, 1853, **86**, 101) in his work on the action of water on various salts, and includes such observations as the following: (1) a dilute aqueous solution of an alkali carbonate on ebullition loses some carbon dioxide; (2) a concentrated solution of sodium carbonate precipitates from a solution of lead nitrate the substance $6(PbO,CO_2),Pb(H_2O_2)$, whilst a dilute solution furnishes the product $3(PbO,CO_2),Pb(H_2O_2)$; (3) a concentrated solution of borax gives a reddish-violet colour with reddened litmus paper, whereas a dilute solution of borax gives a blue colour; (4) alkaline osmates are inodorous when dry, but on solution in water develop the odour of osmic acid, and, similarly, a dilute aqueous solution of an alkali salt of a fatty acid has always a slight odour of the fatty acid, although the dry salt may be inodorous. The action of water in these cases is (*a*) chemical (in effecting hydrolysis) and (*b*) physical (in maintaining by its mass the new condition set up by the hydrolysis). T. A. H.

Hydrolysis of the Salts of Weak Acids and Weak Bases and its Variation with the Temperature. HARALD LUNDÉN (*J. Chim. Phys.*, 1907, 5, 574—608).—The dissociation constants, k_a and k_b, of certain weak acids and bases, of which the values of k_a and k_b respectively lie between 10^{-7} and 10^{-10}, have been determined by conductivity measurements as previously described (Abstr., 1907, ii, 443) at intervals of temperature between 10° and 50° (in the case of boric acid, only between 15° and 40°).

For boric acid, k_a for the dissociation $H_3BO_3 \rightleftharpoons H^{\cdot} + H_2BO_3{}'$ is 5·48, 6·62, and $8·49 \times 10^{-10}$ at 15°, 25°, and 40° respectively; when the acid is neutralised with ammonia, only the salt $NH_4H_2BO_3$ is formed in appreciable amount. For pyridine, k_b is 1·06, 4·25, and $8·6 \times 10^{-9}$ at 10°, 40°, and 60° respectively; for *p*-nitrophenol, k_a is 4·5, 7·0, and $12·7 \times 10^{-8}$ at 10°, 25°, and 50° respectively, and for 2 : 4 : 6-trimethylpyridine, k_b is 1·22, 2·05, and $3·75 \times 10^{-7}$ at 10°, 25°, and 50° respectively. In connexion with the results for *p*-nitrophenol, it is pointed out that the colorimetric method for determining the dissociation constants of indicators employed by Friedenthal and Salm (Abstr., 1906, ii, 218) does not give trustworthy results.

The dissociation constant for water has been calculated from the constants for *p*-nitrophenol and 2 : 4 : 6-trimethylpyridine, and the degree of hydrolysis of the salt formed by these two compounds; the values are 0·31, 1·05, and $5·17 \times 10^{-14}$ at 10°, 25°, and 50° respectively, in excellent agreement with Kohlrausch's values from the conductivity of pure water.

From the variation of the dissociation (ionisation) and of the degree of hydrolysis of the salts with temperature, the heats of dissociation and of neutralisation respectively have been calculated for the compounds mentioned above. The values obtained agree satisfactorily with those obtained calorimetrically as far as comparison is possible. The heat of neutralisation of boric acid is $11,440 - 37·8t$ cal., and that of pyridine $6037 - 14·5t$ cal.; the heat of dissociation of ammonia is $-2608 + 58·05t$ cal.

The heat of dissociation increases with the temperature for all the electrolytes examined, but the temperature-coefficient for the heat of neutralisation may be positive or negative. G. S.

Theory of the Saponification of the Glycerides. Rudolf Wegscheider (*Monatsh.*, 1908, **29**, 83—133).—A discussion of the results of various authors who have studied the hydrolysis of the glycerides. The view that the hydrolysis takes place in three stages is supported by observations made in determining the velocity constants of the hydrolysis of other esters. The arguments are shown to apply to all the seven reactions which may occur within the three stages. The conditions are laid down under which the velocity coefficients of similar reactions, with substances differing in the number of their reactive groups, are proportional to the numbers of such groups.

The theory of the progressive hydrolysis of the glycerides is developed on the assumption that all the possible isomerides are formed. New conditions are discovered, under which the whole reaction may be bimolecular or, in presence of an excess of the hydrolysing agent, unimolecular, and a basis is provided for the theoretical treatment of observed deviations.

The following general conclusions are arrived at: the hydrolysis of the glycerides takes place in stages, in the course of which all the possible isomerides are formed. If the whole reaction, as measured by the amount of acid liberated, takes place with tri- or di-glycerides approximately according to the law of unimolecular reactions, and if the unimolecular constants for the hydrolysis of mono-, di-, and tri-glycerides are almost equal, the velocity constants for the various reactions must be related as follows: (1) the hydrolysis constants of the two monoglycerides must be equal. (2) The hydrolysis constant of the *s*-diglyceride must be double that of a monoglyceride and equal to the sum of the two hydrolysis constants of the *as*-diglyceride. (3) The sum of the two hydrolysis constants of the triglyceride is three times the constant for a monoglyceride. This is the case in the hydrolysis in acid solution, but has not yet been shown to apply to the alkaline hydrolysis.

If the hydrolysis of the triglyceride is unimolecular, but not that of the diglyceride, the various hydrolysis constants must be represented by the expressions: $k_1 = 3KB/C$, $k_2 = -3K/C$, $k_{11} = K$, $k_{21} + k_{22} \geqq 2K$, $k_{10} = [K(2a - k_{21}) - a^2]/B - k_{21}$, $k_{20} = K$, in which K is the constant for the whole, apparently unimolecular, reaction, $a = k_{21} + k_{22}$,

$B = 2K - a$, and $C = K - a$, or by the expressions: $k_1 + k_2 = 3K$, $k_{11} = [12K - k_1 + k_{21}(3Kk_1)^2]/k_1(3K + k_1)$, $k_{21} \leqq K$, $k_{22} = [6K(K - k_{21})]/3K + k_1$, $k_{10} = [12Kk_1 + k_{21}(3K - k_1)^2]/2k_1(3K + k_1)$, $k_{20} = K$.

The non-appearance of mono- and di-glycerides in recognisable amounts amongst the products of the hydrolysis of insoluble triglycerides in heterogeneous systems by means of aqueous solutions cannot be urged as an argument against the view that the hydrolysis takes place in stages, as, in general, if the transformation of an almost insoluble substance is accompanied by a process of solution, the appearance of an intermediate product in quantity is possible only if its velocity of transformation or its solubility is markedly smaller than that of the original substance. The various points are treated mathematically in an appendix which forms the second and larger part of the paper. G. Y.

Catalytic Power of Silica and Alumina. JEAN B. SENDERENS (*Compt. rend.*, 1908, **146**, 125—127. Compare Abstr., 1907, i, 577).—The silica precipitated from sodium silicate, washed free from acid, dried, and completely dehydrated by moderate calcination, is a catalyst of alcohols giving ethylenic hydrocarbons exclusively. Thus it dehydrates ethyl alcohol at 280°, giving 99·5% of ethylene. But the same silica, after being calcined in a platinum crucible at a bright red heat for an hour, does not act on ethyl alcohol below 340°, and then gives 5·3% of hydrogen and 94·7% of ethylene, whilst, if it is calcined for six hours at a white heat, the decomposition of ethyl alcohol requires a temperature of 390° and then gives 17·1% of hydrogen. Hyaline quartz, when finely powdered, does not begin to catalyse alcohol below 460°, giving ethylene and 52% of hydrogen, and, if this quartz is previously calcined for six hours at a white heat, the decomposition temperature of alcohol rises to 480° and the yield of hydrogen to 95·2%.

Similar behaviour is observed with alumina. The latter, prepared by precipitation from a salt, washed, dried, and slightly calcined, is exclusively a dehydrating catalyst towards alcohols, giving with ethyl alcohol 99·5% of ethylene at 275°, whilst, after calcination for six hours at a white heat, it does not decompose alcohol below 420° and then gives 12% of hydrogen.

The conclusion is drawn that silica and alumina, when gently calcined, are dehydrating catalysts, whilst prolonged calcination, besides diminishing their catalytic power, tends to make it more dehydrogenating in character. The author considers that this will explain the disagreement amongst chemists as to the action of silica and alumina on alcohols. E. H.

Action of Alternating Currents of High Frequency on the Decomposition of Hydrogen Peroxide by Colloidal Platinum. A. LEBEDEFF (*Bull. Soc. chim.*, 1908, [iv], **3**, 56—75).—For these experiments a coil, giving a spark 40 cm. long, was employed with a primary current varying from 2·5 to 4·5 amperes. The platinum electrodes were each 2 sq. cm. in area, and each was enclosed in a small glass tube having a constricted aperture covered with parchment paper and dipping in the reaction liquid, contained in a voltameter, which is figured in the original. The water employed as a solvent had a conductivity 2×10^{-6}, and the colloidal platinum was prepared by Bredig and von Berneck's method (Abstr. 1900, ii, 213). The whole apparatus was immersed in a thermostat at 25°.

In the several series of experiments made, it was found that the normal rate of decomposition of the peroxide by the colloidal platinum (Bredig and von Berneck, *loc. cit.*) was diminished under the influence of alternating currents of high frequency, and the irregularity of the diminution is attributed to irregularity in the primary current employed. On the contrary, the rate of decomposition increased under the influence of the current when a small quantity of sodium hydroxide was added to the reaction liquid, thereby increasing its conductivity. When a direct current from a 70 volt battery was employed, no effect on the rate of decomposition of the peroxide was noticed, and this was also the case when a direct discontinuous current was taken from the coil, with an air-break of 0·75 cm. length.

The greater part of the paper is taken up with a discussion of the bearing of these preliminary results on theories of catalytic action, and it is shown that the results are readily explicable on the assumption that catalytic action is due to a change in state of the surface of the catalyst, and in this connexion attention is directed to Helmholtz's idea that between the two phases, solid and liquid, there exists a thin double layer, carrying an electric charge, which tends to diminish surface tension. The influence of an electric current on catalytic action can then be explained as due to the change in potential difference, and consequently in surface tension, that it induces, and the further effect due to the addition of an electrolyte, such as sodium hydroxide, to the reaction liquid would be explained as due to change in potential difference induced by the electrical charges on the ions. As to the mechanism of the reaction, the author dissents from Haber's view (Abstr., 1900, ii, 720) that the platinum is alternately oxidised and reduced, and suggests, instead, that the oxygen is merely stored temporarily in the colloidal platinum in the form of a solid solution.

T. A. H.

Catalysis. I. Catalysis of Esters and of Imino-esters by Acids. JULIUS STIEGLITZ (*Amer. Chem. J.*, 1908, **39**, 29—63).—This paper is based on the results of experiments which have not yet been described.

Methyl iminobenzoate is slowly decomposed by water with formation of methyl alcohol and benzonitrile, very small quantities of methyl benzoate and ammonia being also produced: (1) $NH\colon CPh\cdot OMe \longrightarrow C_6H_5\cdot CN + MeOH$; (2) $NH\colon CPh\cdot OMe + H_2O \longrightarrow Ph\cdot CO_2Me + NH_3$. Both reactions are practically non-reversible under the conditions of the experiment. In presence of hydrochloric acid, however, the velocity of the second reaction is greatly increased, whilst the first reaction may be entirely suppressed. The acid unites with the imino-ester, the hydrochloride is partially hydrolysed, and a condition of equilibrium is established, thus:

$$NH_2Cl\colon CPh\cdot OMe + H_2O \rightleftharpoons OH\cdot NH_2\colon CPh\cdot OMe + HCl.$$

It has been proved that the reacting substance which gives ammonia and a benzoate is the hydrochloride, or rather its positive ion, and that the accelerating action of the acid is simply due to the formation of larger reacting masses of the active ion from the scarcely ionised weak base. Non-electrolytes do not affect the velocity of the reaction between imino-ester salts and water, but electrolytes have a decided "salt effect" (Euler, Abstr., 1900, ii, 269). The decomposition into nitrile and alcohol, according to reaction (1), is greatly accelerated by the addition of alkali hydroxides, owing to an increase in the concentration of the negative ions. In the decomposition of an imino-ester in aqueous solution, the non-ionised molecules of the ester also break down into nitrile and alcohol, but the velocity constant is very small in comparison with that of the negative ions. An imino-ester decomposes, therefore, in accordance with three simultaneous reactions, each proceeding with an established velocity constant:

(1) $\overset{+}{N}H_2{:}CPh{\cdot}OMe \longrightarrow Ph{\cdot}CO_2Me + \overset{+}{N}H_4$, (2) $\overset{-}{N}{:}CPh{\cdot}OMe \longrightarrow$
$PhCN + \overset{-}{O}Me$, and (3) $NH{:}CPh{\cdot}OMe \longrightarrow PhCN + MeOH$.

A mathematical treatment of these reactions is given, and their theoretical significance and application to the catalysis of ordinary esters are discussed. The results of the work lead to the conclusion that none of the usual assumptions regarding catalytic action (compare Euler, Abstr., 1900, ii, 532; 1901, ii, 5; 1904, ii, 318) is absolutely true under any conditions, and that the only fundamental fact common to all catalytic actions is that of acceleration, due to an increase in the active mass or concentration of a reacting component. E. G.

Catalysis. II. Catalysis of Imino-esters. JULIUS STIEGLITZ (*Amer. Chem. J.*, 1908, **39**, 166—183. Compare this vol., ii, 29, and preceding abstract).—It was stated in the earlier paper that the catalysis of an imino-ester may take place in either of two ways: (1) $R{\cdot}C({:}NH){\cdot}OR' + H_2O \longrightarrow R{\cdot}CO_2R' + NH_3$, and (2) $R{\cdot}C({:}NH){\cdot}OR' \longrightarrow R{\cdot}C{\vdots}N + R'{\cdot}OH$. The former reaction is enormously accelerated by acids, and the latter by alkali hydroxides. Evidence was adduced to show that the reacting component in (1) is the positive imino-ester ion, $R{\cdot}C({:}\overset{+}{N}H_2){\cdot}OR' \longrightarrow R{\cdot}CO_2R' + \overset{+}{N}H_4$, and in (2) the negative ion, $R{\cdot}C({:}\overset{-}{N}){\cdot}OR' \longrightarrow R{\cdot}C{\vdots}N + \overset{-}{O}R'$. A third reaction takes place in the absence of acid or alkali, involving the decomposition of the imino-ester according to (2), and, in this case, the reacting component is the non-ionised imino-ester itself. Each of these reactions proceeds with its characteristic velocity constant.

A further study of the subject has led to the following conclusions. Imino-esters resemble acid esters in being decomposed much more rapidly by alkali hydroxides than by acids. The decomposition in aqueous solution cannot be accounted for by the decomposition of the negative ion by a process of autocatalysis, or by assuming that it is produced by ionisation due to its amphoteric character; the reacting mass is the non-ionised ester.

The acceleration of the decomposition according to (1) being greatly accelerated by acids, it was thought possible that the reacting component was not all the imino-ester salt, but only its positive ion. It has been found, however, that a second accelerating force is involved, and that the imino-ester salt itself, as an electrolyte, exerts a "salt effect" in its own catalysis. This effect is probably concerned with an increase in the ionisation of water.

The salts of those imino-esters which are the weakest bases have the greatest velocity of decomposition.

A series of analogies between imino-esters and acid esters is given, and it is shown that the chief point of difference between the two classes of substances lies in the more pronounced basic properties of the former, and the formation of salts which are comparatively little hydrolysed. E. G.

Catalysis. Salomon F. Acree (*Amer. Chem. J.*, 1908, **39**, 145—156).—Polemical. A reply to Stieglitz (this vol., ii, 29). E. G.

Catalysis. VII. Reaction of Carbonyl Compounds with Hydroxylamine and Hydroxylamine Hydrochloride. Salomon F. Acree (*Amer. Chem. J.*, 1908, **39**, 300—309. Compare Acree and Johnson, Abstr., 1907, ii, 856).—This paper has been written in view of the recent work of Abel (this vol., ii, 26), Lapworth (Trans., 1907, **91**, 1133), Landrien (Abstr., 1905, ii, 445), and Euler (Abstr., 1907, ii, 1098).

The data obtained by Acree and Johnson indicate that acetone and hydroxylamine in aqueous solutions combine readily and nearly completely, thus: $(CH_3)_2CO + NH_2{\cdot}OH \rightleftharpoons (CH_3)_2C{:}N{\cdot}OH + H_2O$, and that the velocity of the reaction is accelerated by acids owing to the formation of cations which are more reactive than the free bases:

$$(CH_3)_2CO + \overset{+}{N}H_3{\cdot}OH \rightleftharpoons (CH_3)_2{:}\overset{+}{N}H{\cdot}OH + H_2O \text{ or}$$

$$(CH_3)_2C{\cdot}\overset{+}{O}H + NH_2{\cdot}OH \rightleftharpoons (CH_3)_2C{:}N\overset{+}{H}{\cdot}OH + H_2O.$$

The quantitative results seem to show that the free bases, hydroxylamine, and acetoxime, as well as their cations, enter into the reaction. In this and in other cases, the question as to whether the free base, dissociated salt, or non-dissociated salt undergoes transformation depends simply on the relative activity of each in the particular reaction. If a quantity of acid is added which is not sufficient to use up all the base, the non-catalysed and catalysed reactions take place side by side each with measurable rapidity, and in this case the velocity of the reaction cannot be proportional to the concentration of the catalysing agent. In the presence of alkali hydroxide, the reaction is greatly accelerated, and proceeds nearly to completion. The alkali probably forms small amounts of $NH_2\overset{-}{O}$ ions, which react much more rapidly with acetone than hydroxylamine does:

$$COMe_2 + NH_2OH + \overset{+}{K} + \overset{-}{O}H \rightleftharpoons$$

$$COMe_2 + NH_2\overset{-}{O} + \overset{+}{K} + H_2O \rightleftharpoons CMe_2{:}N\overset{-}{O} + \overset{+}{K} + 2H_2O.$$

The acetone may, however, form a salt, the anions of which react with the hydroxylamine:

$$COMe_2 + \overset{+}{K} + \overset{-}{OH} + NH_2OH \rightleftharpoons$$

$$OH\cdot CMe_2\overset{-}{O} + NH_2\cdot OH + \overset{+}{K} \longrightarrow CMe_2{:}N\overset{-}{O} + \overset{+}{K} + 2H_2O.$$

The equilibrium point for the non-catalysed reversible reaction between acetone and hydroxylamine in concentrations of 1 gram-mol. per litre is different from that of the catalysed reversible reaction in which the concentrations of the acetone, hydroxylamine, and hydrochloric acid are also each 1 gram-mol. per litre, and the equilibrium in the latter case varies greatly with the variation in the amount of hydrogen ions of the catalyst.

A catalysing agent may influence the velocity of a reaction physically by condensing the reacting substances on the surfaces of solids, thus increasing the effective concentration, or by imparting energy to, or withdrawing it from, the solution. A catalyst may also change the velocity chemically by altering the concentration of some substance taking part in the reaction, or by forming some new substance which yields the same end-products. In some cases, side-reactions may be developed or suppressed by the addition or removal of the catalysing agent. E. G.

Landolt's Experiments on Change of Weight in Chemical Transformation. T. H. Laby (*Chem. News*, 1908, **97**, 1—3).—A summary and discussion of Landolt's results (Abstr., 1906, ii, 528).

G. S.

Observations and Deductions obtained from a Consideration of the Numbers given for the Atomic Weights of the Elements by the International Committee (1905), which lead to a Rational Determination of the Constitution and Structure of each Element. Hawkworth Collins (*Chem. News*, 1907, **96**, 176—177).—Certain relationships between the approximate numbers which represent the atomic weights of the twenty-eight elements with atomic weights below 60, as exact multiples of that of hydrogen, are noted. Deductions involving the assumption that the elements contain protyle are made. H. M. D.

Reciprocal Displacement of the Constituents of Molecular Compounds and their Relative Stability. Boris N. Menschutkin (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1548—1565. Compare Abstr., 1907, ii, 751).—To determine the ability of one substance to replace another in a molecular compound, the latter is dissolved in a small quantity of the desired organic compound and the mixture left in a desiccator. The resulting crystals are then decomposed by water and the products analysed. The following is the order of relative stability of the molecular compounds formed by magnesium bromide and iodide with organic substances. Carbamide; water; aniline, acetamide, ethyl carbamate, formic acid; methyl alcohol; ethyl alcohol; acetonitrile, acetic anhydride; acetic acid; propionic acid; ethyl acetate, acetone; ethyl orthoformate, benzaldehyde; methyl acetate;

acetal, acetyl chloride; methylal; ethyl ether; anisole; anethole (which does not yield a compound).

The substances separated only by commas form molecular compounds of very nearly equal stability and do not replace one another. The substances at the close of the list yield the most unstable compounds, and are readily replaced by those before them.

In general, substances with a high dielectric constant, and also those with a high coefficient of association, form the most stable compounds with the magnesium halides, but there seems to be no direct quantitative relation between the stability and the physical properties of the organic constituent. Of the substances containing oxygen, the most stable compounds are formed by those containing the hydroxyl group, next come those with a carbonyl group, and finally substances of the type R·O·R. Compounds containing an amino-group are as stable as those containing an hydroxyl group, and, contrary to Werner's statement, it is highly probable that the constituents of a molecular compound containing both an NH_2 and a C:O group are connected to one another by means of the nitrogen atom. Qualitative experiments show that, whilst little heat is developed in the formation of the unstable molecular compounds, considerable quantities are developed in the case of the more stable compounds.

Z. K.

Lecture Experiments with Ozone. Carl D. Harries (*Ber.*, 1908, **41**, 42—43).—(1) A stoppered cylinder about 30 cm. long is filled with ozonised oxygen; the presence of ozone in the cylinder is shown by introducing a piece of potassium iodide starch-paper. About 50 c.c. of turpentine oil are poured quickly into the cylinder, which is then well shaken; if a piece of potassium iodide starch-paper is now placed in the cylinder, it will not turn blue, but does so when dipped in the ozonised turpentine oil.

(2) A strip of absorbent paper is saturated with turpentine oil, the excess removed by pressing between drying paper, and the strip then placed in a long, wide cylinder full of ozonised oxygen; in a few seconds, the turpentine oil ignites and burns with a luminous, smoky, dull red flame.

W. H. G.

Balances with Non-metallic Pans. Ernst Bornemann (*Chem. Zeit.*, 1908, **32**, 125—126).—Attention is called to the trouble occasionally experienced in accurate weighings of glass utensils when using a balance with glass pans. The author finds this is caused by electric disturbances, and advises covering the pans with a disc of sheet copper.

L. de K.

Inorganic Chemistry.

Slow Combination of Chlorine and Hydrogen under the Influence of Heat. HEINRICH SIRK (*Zeitsch. physikal. Chem.*, 1908, **61**, 545—565).—Mixtures of hydrogen and chlorine in different proportions, occasionally with hydrogen chloride in addition, were heated in glass vessels in a thermostat at 242·5°. After different intervals, the contents of the glass vessels were analysed. The reacting gases were protected from light throughout.

The combination of hydrogen and chlorine under the influence of heat is a very complicated problem, and for some of the author's observations no explanation can be suggested. The initial rate of combination is proportional to the chlorine concentration (c), and is independent over a wide range of the concentrations of hydrogen and hydrogen chloride. At the same time, the reaction is not a unimolecular one throughout, for the value of $k = 1/t.\log.c/(c-x)$ diminishes as the reaction proceeds. If the chlorine, or the mixture of chlorine and hydrogen, has been heated previously, the combination of the two gases is accelerated (compare Burgess and Chapman, Trans., 1906, **89**, 1399); a similar effect is produced by previous exposure of the chlorine to light. The activity of a mixture of hydrogen and chlorine is diminished by contact with concentrated sulphuric acid, but this apparently has nothing to do with the removal of traces of moisture. One experiment, made at 258°, indicates that the temperature-coefficient of the rate of combination of hydrogen and chlorine is 1·6 for a rise of 10°. J. C. P.

Decomposition of Hydrogen Iodide in Light. MAX BODENSTEIN (*Zeitsch. physikal. Chem.*, 1908, **61**, 447—448).—The author found previously (Abstr., 1897, ii, 252) that the decomposition of hydrogen iodide in the dark at high temperatures was a bimolecular reaction, whereas the decomposition in light was a unimolecular reaction. The suggestion that this difference is only an apparent one, and that the lowering of the order of the reaction might be due to the absorption of the active rays by the surface layer of the hydrogen iodide, has been tested by experiment. The glass tubes containing the hydrogen iodide were surrounded by wider tubes, containing in some cases air, in other cases hydrogen iodide, and were then exposed to sunlight. The decomposition in the inner tubes was practically equal under the two sets of conditions; hence the suggested explanation is disproved. J. C. P.

Action of Oxygen on Metals. EDUARD JORDIS and W. ROSENHAUPT (*Zeitsch. angew. Chem.*, 1908, **21**, 50—66).—A complete account of work already partly published (this vol., ii, 98, 107). It is now found that above 145°, air attacks copper more energetically than does oxygen. The greater oxidising power of air and of moist oxygen, as compared with that of dry oxygen, is ascribed to the participation in the reaction of oxidation products of nitrogen and water. The course of the oxidation depends on the behaviour of the surface layer of the metal; progressive oxidation is possible only if the oxide first formed does not act as a protective coating. An oxidisable surface may be the result of (*a*) the solution of the oxygen in the metal as such or as an alloy of copper and oxygen; (*b*) the diffusion of the oxygen through the layer of oxide which may dissolve the oxygen or be merely porous to it; (*c*) the alternate formation of lower and higher oxides, or (*d*) the layer of oxide scaling off from the metal. Examples of each case are given. During the oxidation, metallic filings shrink together and form a mass. With suitable apparatus, it would be possible to judge from the surface colours as to the ratio M : O in the outermost layer of the metal. G. Y.

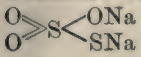
[Formation of Ozone, Nitrogen Peroxide, and Hydrogen Peroxide in Reactions in Air which Develop High Temperatures, &c.]. EDWARD H. KEISER and LEROY MCMASTER (*Amer. Chem. J.*, 1908, **39**, 101—104).—See this vol., ii, 223.

Presence of Sulphur in some of the Hotter Stars. SIR NORMAN LOCKYER (*Proc. Roy. Soc.*, 1907, **80**, *A*, 50—57).—Certain lines in the spectrum of a star (Rigel) have been found to coincide in wave-length with prominent lines in the spark-spectrum and vacuum-tube spectrum of sulphur. There are, however, in that part of the spectrum in which comparison is possible, at least two well-defined lines ($\lambda = 4253{\cdot}8$, $4285{\cdot}1$, and possibly $4295{\cdot}0$) in the spark-spectrum of sulphur which are not present in the spectrum of Rigel, but these two lines are present in certain stars hotter than Rigel. The evidence for the presence of sulphur in stars is therefore regarded as conclusive. G. S.

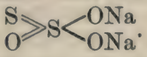
Behaviour of Thiosulphuric Acid and its Use in Volumetric Analysis. ANGELO CASOLARI (*Gazzetta*, 1907, **37**, ii, 601—608).—The decomposition of thiosulphuric acid begins immediately the acid is liberated from its salts, but titration of acidified solutions of sodium thiosulphate with iodine shows that the decomposition occurs slowly in dilute solutions. Sodium thiosulphate is hence capable of giving exact results when titrated with acid solutions (compare this vol., ii, 222). The opalescence appearing in solutions of sodium thiosulphate in presence of acid is due to the presence of a small proportion of free sulphur, which, probably owing to a change of state, has assumed the molecular form. Such opalescent liquids become clear when sulphite ions are added to them or hydrogen ions are removed, thiosulphuric acid being regenerated. When solutions of thiosulphuric acid are rendered alkaline and then faintly acidified, they yield an appreciable odour of hydrogen sulphide; the same is the case with the thionic acids which liberate sulphur. T. H. P.

Action of Carbonates on Tetrathionates. V. AUGUST GUTMANN (*Ber.*, 1908, **41**, 300—307. Compare Abstr., 1905, ii, 384, 813; 1906, i, 149; 1907, ii, 862).—The action of alkali carbonates on sodium tetrathionate is different from that of alkali hydroxides; in addition to sodium thiosulphate, sulphate is formed instead of the sulphite obtained in the latter case. The experiments were carried out with sodium, potassium, and lithium carbonates, as well as ammonia, the solutions being boiled for half an hour. Quantitative experiments carried out either by the author's method (Abstr., 1907, ii, 812), or by direct titration of the excess of carbonate, show that the reaction takes place in accordance with the equation : $4Na_2S_4O_6 + 5Na_2CO_3 = 7Na_2S_2O_3 + 2Na_2SO_4 + 5CO_2$, or $4S_4O_5 = 7S_2O_2 + 2SO_3$.

When, however, the carbonates of barium, strontium, and calcium were examined, it was found that the thiosulphate could not be determined by the cyanide and silver nitrate method as silver sulphide was precipitated, notwithstanding the fact that there was no sulphide in the solution before treatment with cyanide. This accords with Drechsel's suggestion that thiosulphate may have the isomeric forms



$\begin{matrix}O\\O\end{matrix}\!\gg S<\begin{matrix}ONa\\SNa\end{matrix}$ and



$\begin{matrix}S\\O\end{matrix}\!\gg S<\begin{matrix}ONa\\ONa\end{matrix}$.

An aqueous solution of sodium tetrathionate on boiling forms sodium sulphate, sulphur dioxide, and sulphur, not trithionate and sulphur as stated by Kessler (*Ann. Phys. Chem.*, 1848, [ii], **74**, 253).

W. R.

Synthesis of Ammonia. Hermann C. Woltereck (*Compt. rend.*, 1908, **146**, 124—125. Compare Abstr., 1904, ii, 115 ; Brunel and Woog, this vol., ii, 34).—When a mixture of nitrogen (1 vol.) and hydrogen is passed over reduced iron, spread in thin layers on asbestos fibre, and heated at 550°, small quantities of ammonia are formed. The yield is increased slightly by substituting the oxide for the metal, but in both cases the reaction stops after a time. Similar results are obtained with the oxides of nickel, cobalt, copper, cadmium, silver, lead, bismuth, chromium, and iron, the last three giving the best yields. The reaction is made continuous by replacing the nitrogen by air, and the results are improved by introduction of water vapour, whilst the hydrogen can be replaced by coal gas freed from nitrogenous products. Passage of 100 litres of a mixture of hydrogen (1 vol.) and air (78 vols.) through water kept at 80°, and then over iron oxidised and reduced by carbon monoxide before the experiment, gave at different temperatures the following amounts of ammonia: 260—300° 0·0803 gram, 300—350° 0·204 gram, 350—400° 0·119 gram, 400—450° 0·0134 gram, 450—550° 0·0411 gram, 550—650° 0·0236 gram, all the experiments occupying 4·5 hours. These results show that 300—350° is the most favourable temperature. Diminishing the velocity of the gas, that is, prolonging its contact with the iron, diminishes the yield. Other oxidisable materials which can be substituted for the reduced iron are coke and wood-charcoal, but better results are obtained with peat. A series of comparative experiments using sugar-charcoal and varying the temperature, and the volume and velocity of the mixed gases, show that the best results are obtained at 450° with 40 litres of gas passing in six hours, in which case 0·9 gram of ammonia is formed per 100 grams of charcoal burned. E. H.

Electrolytic Reduction of Hydroxylamine at Copper Cathodes. Julius Tafel and Hans Hahl (*Zeitsch. anorg. Chem.*, 1908, **56**, 375—384).—In a previous paper (Abstr., 1902, ii, 559), it was shown that hydroxylamine sulphate, dissolved in water containing a large proportion (30—50%) of sulphuric acid, is not reduced at a copper cathode, whilst Flaschner (Abstr., 1907, ii, 454) has observed a certain amount of reduction in dilute sulphuric acid solution. It is now shown that reduction always takes place when the sulphuric acid concentration in the layer of electrolyte in contact with the cathode is reduced beyond a certain point; and when there is no excess of acid; in other words, when hydroxylamine sulphate itself is electrolysed, the reduction is quantitative. These results are most readily accounted for on the view that only free hydroxylamine (produced in this case by partial hydrolysis of the sulphate), but not the hydroxylammonium ion, $NH_3OH^{\cdot}$, is reduced at a copper cathode. G. S.

Analysis of the Oxides of Nitrogen by means of their Ultra-red Absorption Spectra. EMIL WARBURG and G. LEITHÄUSER (*Sitzungsber. k. Akad. Wiss. Berlin*, 1908, 148—153).—The absorption spectra of the oxides of nitrogen and of ozone for ultra-red radiation between the wave-lengths $2{\cdot}7\mu$ and 7μ have been determined. The apparatus consisted of a Nernst lamp as the radiating source, a mirror spectrometer provided with a fluorspar prism, and a vacuum-bolometer as the receiving instrument. The maxima of absorption are very different for the various oxides of nitrogen; the wave-length values and the angles of minimum deviation corresponding with these absorption maxima are tabulated for N_2O_5, N_2O_4, NO_2, NO, N_2O, and O_3. The wave-lengths characteristic of the N_2O_4 and NO_2 molecules were determined by observations on nitrogen peroxide at different temperatures.

The data are applied to the examination of the products formed when electric discharge takes place in air. It is found that the action of the silent discharge, in the Siemens' ozoniser, not only yields ozone, but also nitrous oxide and nitrogen pentoxide. Spark discharge through air between platinum electrodes yields nitrogen peroxide and nitrous oxide. Alternating arc discharge at high potential in dry air yields only nitrogen peroxide. H. M. D.

Preparation of Pure Nitrites from Nitrous Fumes. BADISCHE ANILIN- & SODA-FABRIK (D.R.-P. 188188).—Inasmuch as the oxidation of nitric oxide to nitrogen trioxide is known to occur very rapidly, whilst the further oxidation to nitrogen peroxide proceeds relatively slowly, it has been recently suggested by Raschig that if the oxides from atmospheric nitrogen could be absorbed in about one second after their production in the electric arc it would be possible to prepare in this way pure nitrous acid or nitrites. It has now been found that this inconveniently rapid absorption of the gas is unnecessary if only the gaseous mixture containing chemically combined nitrogen and oxygen in the proportion $N_2 : O_3$ is heated at 300° until absorption occurs. In these circumstances, the further oxidation to nitrogen peroxide is almost entirely inhibited, and pure nitrites can be prepared on a technical scale by absorbing with alkali hydroxides or carbonates, or even with the hydroxides of the alkaline earths. As the absorption of the heated gas leads to the generation of steam, solutions of low vapour pressure are employed in order that the action

may not be retarded owing to dilution of the gases with steam. With this end in view, strong solutions of nitrites are employed as absorbents.
G. T. M.

Heteromorphic (Allotropic) Modifications of the [Elements of the] Phosphorus–Arsenic Group. GOTTLOB E. LINCK (*Zeitsch. anorg. Chem.*, 1908, **56**, 393—400).—The paper contains a summary of the progress of knowledge as to the allotropic modifications of the elements of the phosphorus group since the author's former publication on the subject (Abstr., 1899, ii, 415). The work of Reppert (*Diss. Halle*) on the modifications of arsenic is adversely criticised in some respects.

The crystals of red phosphorus (Hittorf's phosphorus) are biaxial and probably monoclinic.
G. S.

Hittorf's Phosphorus. ALFRED STOCK (*Ber.*, 1908, **41**, 250—251. Compare Linck, preceding abstract).—Largely polemical. Stock and Johannsen (*Diss. Berlin*, 1904) found that Hittorf's crystalline, red phosphorus, described as crystallising in the hexagonal hemihedric system, in reality forms reddish-brown, transparent plates, which appear violet-red in reflected light; these are biaxial and probably belong to the monoclinic system.
E. F. A.

Transformation of Solutions of White Phosphorus into Red Phosphorus. ALBERT COLSON (*Compt. rend.*, 1908, **146**, 71—73. Compare this vol., ii, 35).—The velocity of the change of white into red phosphorus depends on the temperature and on the pressure of the vapour, and in the present paper the author shows that similar factors regulate the transformation of white phosphorus in solution into red phosphorus; the velocity of the change varies with the temperature and with the concentration of the solution. The experiments were conducted on solutions of phosphorus in oil of turpentine or carbon disulphide placed in sealed tubes, and, in order to avoid inequalities of temperature, these were placed in solutions of phosphorus in turpentine and heated to the required temperature. A solution of phosphorus in oil of turpentine, containing 23 grams per litre, remained clear after heating for fifty-two hours at 230—235°, but gave a thick deposit of red phosphorus after heating for eight to ten hours at 285—290°.

A solution containing 20 grams of phosphorus in a litre of oil of turpentine, deposited red phosphorus after heating for fifty-five hours at 260—265°, whilst a solution of phosphorus in carbon disulphide, containing 90 grams per litre, deposited red phosphorus after heating for fifteen hours at the same temperature. Three tubes containing respectively 150, 125, and 10 grams of phosphorus in 100 grams of carbon disulphide were heated at 225—230°; at the end of four hours the first tube contained a large quantity of red phosphorus, the second tube contained traces of the red phosphorus, whilst the contents of the third tube were unaltered.
M. A. W.

Action of Arsenic Hydride on Solutions of Halogens, Halogen Acids, and other Oxidising Agents. HANS RECKLEBEN and GEORG LOCKEMANN (*Zeitsch. anal. Chem.*, 1908, **47**, 105—125).—Arsenic hydride is oxidised quantitatively to arsenic acid by iodine, bromine, and chlorine in presence of water; hypochlorites and hypobromites act in a less satisfactory manner. In presence of a catalyst, the oxidation may be carried out by iodic acid and iodates, also by bromic acid and bromates. Chloric acid oxidises it to arsenious acid, but chlorates are quite inactive. Perchlorates in acid solution and in presence of a catalyst (a trace of iodine, for instance) act but very slowly. Periodates act like iodates, but much more slowly. Permanganates in neutral or acid solution, also alkaline ferricyanide (very slowly) and potassium dichromate in sulphuric acid solution, absorb the arsenic hydride completely. Nitric acid, sulphuric acid, solutions of persulphate, chromate, dichromate, and neutral ferricyanide absorb arsenic hydride very slowly and incompletely, whilst solutions of metallic nitrites, nitrates, hydrogen sulphates, and arsenious and arsenic acids are still less active.

Hydrogen peroxide acts very slowly; at first, arsenic is deposited, which is then gradually oxidised to arsenious or arsenic acid. In contact with potassium or sodium hydroxide and air, a separation of arsenic is noticed. L. de K.

Constitution of the Carbon Molecule from the Standpoint of Thermo-chemistry. H. Stanley Redgrove (*Chem. News*, 1908, **97**, 37).—An attempt to elucidate the constitution of the carbon molecule from a consideration of the heat values of the different types of carbon linkings (compare Abstr., 1907, ii, 446, 604, 929). The formula recently suggested by Dewar (*Chem. News*, 1908, **97**, 19) is not in agreement with thermochemical data. H. M. D.

Density of Graphite. Henry Le Chatelier and S. Wologdine (*Compt. rend.*, 1908, **146**, 49—53).—The belief in the existence of the numerous polymerides of carbon is based on their difference in density; thus the density of amorphous carbon varies from 1 to 1·6, of graphite from 1·8 to 2·6, whilst that of the diamond is practically constant at 3·50 to 3·51. The authors have redetermined the density of graphite from eight different sources, natural or artificial, using a mixture of tetrabromoethane and ethyl ether, in which the graphite floated at any height. Preliminary experiments showed that the discrepancies in the densities of the different specimens were due to the presence of traces of impurities not removed by treatment with nitric acid, or to air in the pores of the graphite which was not completely eliminated in a vacuum. When, however, the graphite was fused with potassium hydroxide, after preliminary treatment with warm fuming nitric acid, washed, and then boiled with hydrochloric acid, D 1·12, dried at a dull red heat, and finally subjected to a pressure of 5000 kilos. per square centimetre, each specimen of graphite had D^{15}_{4} 2·255. M. A. W

Relation Between the Composition of Coal and the Amounts of Carbon Monoxide and Dioxide contained in Gas Distilled from it. Leo Vignon (*Bull. Soc. chim.*, 1908, [iv], **3**, 109—114).—The object of the investigation was to determine what relationship existed between the amount of oxygen in the coal and that in the oxygenated gases produced on its distillation.

Five samples of coal were used, and in these the amounts of calcium carbonate, carbon, hydrogen, nitrogen, sulphur, and oxygen (by difference) were determined, and finally the washed gases produced by their destructive distillation at 900° were analysed.

The results, which are given in detail in the original, show that the more oxygen the coal contains the larger are the amounts of carbon monoxide and dioxide produced on its distillation, and that the quotient of the total oxygen in these two gases, produced on distillation, by the oxygen originally present in the coal ranges from 0·292 to 0·314, that is, rather less than one-third is evolved in these two forms. The relative proportions of the two gases vary with the conditions, and at temperatures above 900° there is a tendency for carbon dioxide to be replaced by the monoxide. T. A. H.

Dissociation of Carbonyl Chloride. MAX BODENSTEIN and GEORGE DUNANT (*Zeitsch. physikal. Chem.*, 1908, **61**, 437—446).—Carbonyl chloride or a mixture of carbon monoxide and chlorine in equivalent proportions was passed through a heated tube and the issuing gas was analysed. At 800°, carbonyl chloride is completely decomposed; at 603°, it is dissociated to about 91%; at 553°, to about 80%, and at 503°, to about 67%. From the corresponding equilibrium constants, the heat effect of the reaction $CO + Cl_2 = COCl_2$ is calculated to be about 23,000 cal., a figure in rough agreement with the calorimetric determinations of Thomsen and Berthelot, and with Nernst's theory (see Nernst, Abstr., 1906, ii, 727; Brill, Abstr., 1907, ii, 233).

Some experiments on the rate of formation and decomposition of carbonyl chloride have been made at 503°, and the results obtained are best represented by the formulæ which Bodenstein and Wolgast have suggested (see this vol., ii, 162). J. C. P.

Dissociation of Fused Silicates. CORNELIO DOELTER (*Monatsh.*, 1907, **28**, 1313—1379. Compare Abstr., 1906, ii, 665).—An investigation of the extent to which silicates in the fused state are electrolytically dissociated, if at all, has been undertaken as a knowledge of this subject is necessary for the elucidation of the results obtained from the general study of fused silicates. In view of the experimental difficulties met with in the course of the work, the results now published must be regarded only as provisional.

It is found that the conductivity of the silicates depends chiefly on the temperature; silicates which in the solid state are almost non-conductors have a conductivity approaching that of dilute salt solutions when raised to a sufficiently high temperature. As at high, but varying, temperatures the different silicates examined have approximately the same conductivity, comparisons must be made only at a given temperature interval above or below the melting points, which are represented on the temperature-resistance curve by a break or by a gradual bend. If the conductivity is measured during cooling, a sharp break occurs in the curve for silicates which crystallise, but there is no break in the curve for those which solidify to a glass.

The increase in the conductivity with rise of temperature may depend on increasing dissociation or on an increase in the mobility of the ions. It is concluded that a gradual change in the conductivity in the neighbourhood of the temperature of solidification must depend at least partly on a diminution of the dissociation, but that a sharp break results chiefly from the marked loss of mobility of the ions which must occur on crystallisation, since such wandering of the ions as may be possible in an amorphous solid cannot take place in a crystalline substance. In connexion with this, the author discusses the relation between the coefficient of internal friction and the conductivity of fused salts.

From the comparison of the results obtained with the different silicates examined, it is concluded that at high temperatures all silicates are electrolytically dissociated; at medium temperatures, orthoclase is dissociated to a greater, labradorite to a smaller, extent than augite or hornblende. Of two silicates, that which melts at the higher temperature is dissociated to the less extent at a given medium temperature. In agreement with this are the results of experiments which show that, whilst simple silicates such as olivine, enstatite, augite, and also labradorite always separate after fusion, other silicates are not reformed. G. Y.

Colloidal Sodium Chloride. CARL PAAL and GUSTAV KÜHN (*Ber.*, 1908, **41**, 51—57).—Relatively stable organosols of sodium chloride, similar to those described previously (Abstr., 1906, ii, 749), are obtained by the action of ethyl chloroacetate, chloroacetone, and phenacyl chloride on ethyl sodioethylmalonate in benzene or ether. The colloidal solution obtained by acting on ethyl sodioethylmalonate with ethyl chloroacetate in benzene, when heated for some time, becomes more viscid, remaining, however, quite liquid and apparently homogeneous. This product, when poured into a glass vessel, deposits a gel on the sides of the vessel, and, when filtered through a filter paper, separates into a gel, which remains on the filter, and into a benzene solution of the organic compounds formed in the reaction, which passes through the filter and is almost free from sodium chloride. The authors propose to name such products *liquid gels*.

The action of sulphuryl chloride on ethyl sodioethylmalonate in benzene, results in the formation of a sodium chloride sol which rapidly changes into the liquid gel. W. H. G.

Colloidal Sodium Bromide and Iodide. CARL PAAL and GUSTAV KÜHN (*Ber.*, 1908, **41**, 58—61. Compare preceding abstract).—Organosols and gels of sodium bromide are obtained by using ethyl sodioethylmalonate instead of ethyl sodiomalonate (Abstr., 1906, ii, 749), and are similar to those previously described (*loc. cit.*). When ether is employed as the solvent, the organosol of sodium bromide changes into a *gel*, which is not gelatinous, but consists of large aggregates of small, transparent, amorphous globules.

It has also been found possible by acting on ethyl sodioethylmalonate with ethyl β-iodopropionate in benzene or ether to obtain an *organosol* of sodium iodide, which is, however, exceedingly unstable, and rapidly changes into a *gel*. The sodium iodide, previously inaccurately described as crystalline (*loc. cit.*), when examined under a microscope, is found to consist of aggregates of amorphous, transparent globules. W. H. G.

Percarbonates. Richard Wolffenstein and Erich Peltner (*Ber.*, 1908, **41**, 280—297. Compare this vol., ii, 183; Constam and von Hansen, Abstr., 1897, ii, 550; von Hansen, 1898, ii, 23; Tanatar, 1899, ii, 482; 1903, ii, 208; Willstätter, 1903, ii, 537; Kasanezky, 1903, ii, 366; Bauer, D.R.-P. 145746).—The investigation of the action of carbon dioxide on peroxide of sodium has led to the preparation of sodium percarbonates containing, in general, water of crystallisation, but not hydrogen peroxide of crystallisation. This is shown by a study of the analytical results and by the mode of preparation, the first product being the normal salt, and the second the hydrogen salt or its anhydride.

Sodium dioxide carbonate, $Na_2CO_4,1\frac{1}{2}H_2O$, is best prepared by first hydrating $\frac{1}{2}$ gram-mol. of sodium peroxide with 50 grams of ice, and then slowly passing a current of carbon dioxide over the mass. The temperature is kept below 0°, and, as soon as the mass becomes pasty, another $\frac{1}{2}$ gram-mol. of sodium peroxide is added in portions. The action is finished when 1 gram-mol. of carbon dioxide has been absorbed. The unstable salt is washed with alcohol and ether, and dried in a vacuum. *Sodium dioxide dicarbonate*, $Na_2C_2O_6$, is obtained when the gas can no longer be absorbed. It is more stable than the normal carbonate.

When a similar series of experiments were carried out with Tafel's sodyl hydroxide (Abstr., 1894, ii, 448), it was found that the dry substance was not acted on by carbon dioxide, but in the presence of a trace of moisture action occurs, the mass becoming warm and decomposing. Sodyl hydroxide containing 26—30% water is kept below 0°, and treated carefully with carbon dioxide, solid or gas, when *sodium trioxide dicarbonate*, $NaHCO_4$ or $Na_2C_2O_7$, results. It is very unstable. The preparation of a *sodium trioxide hydrate*, $Na\cdot O\cdot O\cdot H$, isomeric with Tafel's sodyl hydroxide, $O{:}Na\cdot OH$, is accomplished by treating sodium ethoxide with a mixture of 30% hydrogen peroxide (1 mol.) and absolute alcohol, when it is precipitated. From this material, an isomeric *sodium trioxide dicarbonate*, $NaHCO_4$ or $Na_2C_2O_7$, is obtained in the above way. Washing the product with alcohol and ether removes hydrogen peroxide, but analysis of the washed material agrees with the formula. It is shown that the sodium trioxide hydrate, as above prepared, contains hydrogen peroxide of crystallisation. The dicarbonate is much easier to prepare than its isomeride, is much more stable, and behaves differently towards heat. *Sodium trioxide carbonate*, Na_2CO_5, is formed on treating sodium trioxide hydrate with the calculated quantity of carbon dioxide; it is less stable than the dicarbonate. W. R.

Preparation of Sodium Hydrogen Percarbonates. Emanuel Merck (D.R.-P. 188569).—At low temperatures, hydrated sodium peroxide furnishes sodium percarbonate, Na_2CO_4, on treatment with solid, liquid, or gaseous carbon dioxide. A substance containing a greater proportion of CO_2 is obtained by adding 20 parts of ice to 39 parts of sodium peroxide, and then treating the sodium peroxide hydrate thus produced with 33 parts of carbon dioxide, the mixture being stirred until the reaction is complete. *Sodium hydrogen percarbonate*, $4Na_2CO_3,H_2CO_3$, finds employment as a disinfectant and in the preparation of hydrogen peroxide. G. T. M.

Constitution of Sodium Hyposulphite. E. I. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1588—1617).—See this vol., i., 132.

Rubidium Dichromate. GREGOIRE WYROUBOFF (*Bull. Soc. chim.*, 1908, [iv], **3**, 7—10. Compare *Bull. Soc. chim.*, 1901, [iii], **25**, 105; Abstr., 1901, ii, 149, and Stortenbeker, Abstr., 1907, ii, 764).—The author reiterates his opinion that the monoclinic and triclinic forms of this salt have practically the same solubility, and attributes the greater solubility, observed by Stortenbeker, for the monoclinic form to the fact that this investigator did not render his preparation of the monoclinic form anhydrous by melting it, to eliminate occluded water. Further, he cannot confirm Stortenbeker's observation that the monoclinic form disintegrates slowly in contact with a solution containing excess of the salt and still more slowly when dry. Crystals of the two forms in his experience can be kept for months in contact with a saturated solution of the salt without showing any tendency to transformation, whilst crystals have been kept in a dry state for eighteen years without showing any change in form. T. A. H.

Ammonium Nitrite. JULIUS MEYER and EMIL TRUTZER (*Zeitsch. Elektrochem.*, 1908, **14**, 69—76).—The decomposition of ammonium nitrite in aqueous solution has been studied. The discrepancies in the results of previous observers appear to be due to the use of impure water and impure ammonium nitrite. A trace of carbon dioxide in the water was found to increase the rate of decomposition by about 30%. The ammonium nitrite was purified by fractional precipitation of an alcoholic solution with ether. The dry salt decomposes when kept, ammonia and oxides of nitrogen being formed; these are absorbed by the salt, which becomes yellow. The rate of decomposition of the solutions increases nearly in proportion to the age of the salt. A sample of the salt three months old decomposes almost explosively at 60°. The rates of decomposition of solutions of salt up to eight weeks old were measured and velocity constants calculated. The results are well represented by the equation of the unimolecular reaction, but the velocity constant instead of being independent of the initial concentration of the solution is proportional to it. This is regarded as indicating that the change is due to the catalytic action of the acid decomposition products contained in the dry salt, and this view is also in accordance with the increase of the constants with the age of the salt.

Colloidal platinum appears to accelerate the reaction. T. E.

Ammonium Syngenite. JOH. D'ANS (*Ber.*, 1908, **41**, 187—189). —Replying to Bell and Taber (Abstr., 1907, ii, 867), the author shows that the double sulphate of calcium and ammonium which has not been treated with 50% alcohol, but freed from mother liquor by the use of a hydraulic press, or by washing first with absolute alcohol and then with ether, has the composition represented by the formula $CaSO_4,(NH_4)_2SO_4,H_2O$ (compare Abstr., 1906, ii, 751).

W. H. G.

The Reduction of Silver Oxide by Hydrogen: Colloidal Silver. VOLKMAR KOHLSCHÜTTER (*Zeitsch. Elektrochem.*, 1908, **14**, 49—63).—In order to throw light on the apparent volatilisation of metals in vacuum tubes, the formation of silver films in the reduction of silver oxide by hydrogen has been studied.

The perfectly dry substances do not react; in presence of a trace of moisture, the reaction takes place even at the ordinary temperature. The presence of larger quantities of water retards the change, which always begins at the points of contact of silver oxide and glass. If a little silver oxide dust is distributed over the walls of a flask, which is then filled with hydrogen nearly saturated with aqueous vapour, minute drops of water can be caused to condense round the silver oxide particles by cooling one side of the flask. The reduction takes place in these drops much more rapidly than in the dry particles, and, when the drops are evaporated, a film of silver is left on the glass. The film consists of colloidal silver; it does not conduct electricity at first, but soon passes into the ordinary form of the metal.

When a suspension of silver oxide in pure water is reduced by hydrogen, the reaction takes place almost exclusively in the contact surface of glass and solution, the solid oxide being unattacked; the reduced silver is obtained partly as a mirror and partly as a hydrosol. The rate of reduction of the silver oxide increases with the ratio (glass surface)/(volume of solution), whilst the ratio hydrosol/mirror diminishes. The nature of the hydrosol obtained depends on the kind of vessel used. Ordinary glass and quartz glass give yellowish-brown solutions, Jena glass yields red, blue, or violet solutions, whereas platinum gives no hydrosol, all the silver separating as a crystalline deposit on the platinum. The solutions contain dissolved silver hydroxide in addition to the colloidal silver. The latter is estimated by precipitation with potassium nitrate solution. The conductivity of a solution is only slightly larger than that of a solution of silver hydroxide of the same strength. By passing a current of hydrogen through a solution of hydrosol and silver hydroxide contained in a platinised platinum basin, the silver hydroxide is reduced, leaving a solution of the pure hydrosol. The conductivity of the purified solution is about one-tenth of the original conductivity, and about three times that of the pure water used, so that the removal of electrolytes is very complete. The quantity of colloidal silver in the purified solutions is always less than that in the original solution; calling the difference Δ, and the quantity in the purified solution Ag, the ratio Ag/Δ is usually not very far from unity for all the yellowish-brown solutions, whilst it varies from 3 to 20 for the blue or violet solutions. This is the only difference found between the two kinds of solution; the quantity and quality of dissolved glass does not affect the result; a solution of ordinary glass in a Jena flask gave a blue hydrosol and not a brown one. The author thinks that the original hydrosol molecule is a compound of silver and silver hydroxide; the treatment with hydrogen in a platinum vessel removes both the combined and the dissolved silver hydroxide; the brown solutions would, therefore, contain molecules having $Ag:AgOH = 1$, whilst in the violet solutions this ratio is much larger. If a trace of silver is brought into a borax bead, a brown or violet coloration is obtained as the bead cools, which is probably due to the separation of colloidal silver. The reduction of silver oxide by carbon monoxide also yields silver hydrosols. T. E.

Some Effects of Sunlight on Colourless Glass. Ross Aiken Gortner (*Amer. Chem. J.*, 1908, **39**, 157—162).—It has been shown by Crookes (*Chem. News*, 1905, **91**, 73), Avery (Abstr., 1905, ii, 589), Simpson (*Chem. News*, 1905, **91**, 236), and Rueger (Abstr., 1905, ii, 709) that certain specimens of glass assume a violet colour on exposure to sunlight for a considerable time. Fischer (Abstr., 1905, ii, 320) has found that the same change can be effected in glass containing manganese by exposing it to the ultra-violet rays from a quartz-mercury lamp. In only one case (Alway and Gortner, *Amer. Chem. J.*, 1907, **37**, 1) has the time necessary to produce the coloration been recorded.

Several specimens of glass from various sources have been exposed to the direct action of the sun, and the following observations have been made. Glass which is relatively rich in manganese (about 0·2—0·3%) becomes coloured in less than a month, the degree of coloration being proportional to the manganese present. Most specimens of glass containing only a small quantity of manganese become coloured in less than a year, and the colour becomes deeper if the time of exposure is increased. The production of this violet coloration is a proof of the presence of manganese, but some specimens of glass, although containing this element, do not become coloured. Rueger's suggestion (*loc. cit.*) that glass may become coloured by lying in the proximity of manganese or its ores is untenable. A violet background is more favourable to the action of the ultra-violet rays than one of any other colour. White, yellow, blue, and red act alike, and seem to have no effect on the rate of coloration, whilst brown and black appear to have a retarding action. E. G.

Barium Percarbonate [Barium Dioxide Carbonate]. Richard Wolffenstein and Erich Peltner (*Ber.*, 1908, **41**, 275—280).—According to Duprey (*Compt. rend.*, 1862, **55**, 736) and Balard (*ibid.*, 738), the action of carbon dioxide on barium dioxide in water is to form barium carbonate and hydrogen peroxide. A re-investigation of the reaction according to Duprey's conditions shows that, at the beginning, the hydrogen peroxide formed corresponds with the barium peroxide used, but after some time the action ceases. If instead of using carbon dioxide in excess, barium dioxide is employed in considerable excess, then no separation of hydrogen peroxide occurs, although the carbon dioxide is absorbed. Continued saturation of this solution with the gas leads, however, to the formation of hydrogen peroxide, and in a short time all the active oxygen exists as hydrogen peroxide. The reaction therefore occurs in two stages, and, in order to separate the intermediate compound, *barium dioxide carbonate*, $BaCO_4$, particular care must be taken to avoid the presence of too much water on the one hand, otherwise hydrogen peroxide is liberated, or of too little water on the other, as that leads to the development of heat and decomposition of the compound. It is best prepared by cooling 30% barium dioxide solution to 0°, and slowly saturating the solution with carbon dioxide. The compound is light yellow, and does not lose hydrogen peroxide quickly in cold water, or on washing with ether or alcohol, so that, although the compound has not been obtained free from water, it does not contain hydrogen peroxide of crystallisation. W. R.

False Equilibria. Ernst H. Büchner (*Zeitsch. Elektrochem.*, 1908, **14**, 63—64).—The reaction $MgCO_3,3H_2O + KHCO_3 + nH_2O \rightleftarrows MgCO_3,KHCO_3,4H_2O + (n-1)H_2O$ has been stated by Engel to yield solutions of different composition when the double salt is digested with water, on the one hand, and when magnesium carbonate is digested with a solution of potassium hydrogen carbonate on the other. The experiments have been repeated at 20° and 30°, allowing the reaction to go on for twenty-four to thirty-two days, instead of for a few hours. It appears that the same solution is obtained, but that from four to eight days elapse before equilibrium is reached. T. E.

Magnesium Silicide. Paul Lebeau and Robert Bossuet (*Compt. rend.*, 1908, **146**, 282—284. Compare Gattermann, Abstr., 1889, 342; Winckler, Abstr., 1890, 1372; Vigouroux, Abstr., 1899, ii, 211).—Alloys of magnesium and silicon have been prepared, those containing 0—45% of silicon by heating fragments of magnesium with a mixture of magnesium filings and potassium silicofluoride, and those containing more than 45% by fusing magnesium filings with crystallised silicon and a small quantity of potassium silicofluoride. Metallographic examination of the polished surfaces of these shows (1) in the alloy containing 0·38% of silicon, grains of magnesium surrounded by a eutectic, but no crystals of the silicide; (2) in alloys containing 6—8% of silicon, well-defined crystals of the silicide in the midst of a eutectic very rich in magnesium; (3) that an alloy containing 40% of silicon is composed mainly of crystals of the silicide and a eutectic differing from the former and containing free silicon, and (4) crystals of free silicon in alloys containing more than 50% of that element. The pure silicide cannot be isolated by treating the alloys with any aqueous reagent, owing to the decomposing action of water, but the magnesium is dissolved away from an alloy containing 25% of silicon by means of ethyl iodide and ether, leaving brilliant, slate-blue, octahedral crystals of magnesium silicide, the analysis of which corresponds accurately with the formula Mg_2Si. Magnesium silicide slowly decomposes water at the ordinary temperature, giving hydrogen, but no silicon hydride; it is vigorously attacked by cold hydrochloric acid, evolving hydrogen and spontaneously inflammable silicon hydrides, and is completely dissociated when heated in a vacuum or in a current of hydrogen at 1100—1200°.

Analyses of alloys containing free silicon show that in every case the ratio of the magnesium to the combined silicon is that required by the formula Mg_2Si. The conclusion is drawn that by the direct action of magnesium on silicon only the single definite compound Mg_2Si is produced. E. H.

The System: Zinc Oxide–Carbon Dioxide–Water. Hans Mikusch (*Zeitsch. anorg. Chem.*, 1908, **56**, 365—374).—As there is much uncertainty with regard to the number of basic carbonates of zinc, the question has been investigated on the basis of the phase rule. Neutral zinc carbonate was hydrolysed progressively with water at 25°, 50°, and 100°, and the composition of the liquid phase and of the residue determined from time to time; conversely, zinc carbonate was formed by the progressive action of carbon dioxide on the hydroxide, and the solid and liquid phases analysed from time to time. In both cases, sodium acetate was added to the liquid phase (compare Hawley, Abstr., 1906, ii, 854) to dissolve sufficient of the carbonate and hydroxide to allow of analysis.

The results indicate that only the compound $5ZnO,2CO_2,4H_2O$ exists; the other basic salts described in the literature are solid solutions of zinc oxide and carbonate. G. S.

Direct Production of Dry Zinc Hyposulphite. Chemische Fabrik Grünau, Landshoff, and Meyer (D.R.-P. 184564).—Hitherto zinc hyposulphite has only been obtained in the form of the sodium double salt, but by means of suitable concentrations employed at definite temperatures it has been found possible to isolate the simple salt ZnS_2O_4 in a dry state. One hundred parts of zinc dust mixed with 150 to 200 parts of water were treated at 45—50° with a rapid stream of sulphur dioxide until the metal had entirely dissolved. The viscid, greyish-yellow mass thus produced, when cooled to the ordinary summer temperature, set to a stiff paste, which was collected and drained in an inert atmosphere.

A large excess of sulphur dioxide must be avoided, as this oxide reacts with the zinc hyposulphite, giving rise to polythionic acids.

G. T. M.

Specific Gravity of Aqueous Solutions of Cadmium Chloride. Eugen von Biron (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1502—1506).—The specific gravity of cadmium chloride solutions of various concentrations has been redetermined, and on the basis of the three most accurate determinations the following formula has been deduced: $10^4 \cdot D_4^{20} = 9983 + 87 \cdot 144p + 0 \cdot 474p^2 + 0 \cdot 00991p^3$ (where p = percentage concentration of the solution in question). The results calculated by means of this formula agree well with the experimental values and also with those obtained by other investigators. Z. K.

Alloys of Copper and Magnesium. G. G. URAZOFF (*J. Russ. Phys. Chem. Soc.*, 1907, **39**, 1566—1581).—The curve expressing the relation between the composition of the copper magnesium alloys and their freezing points consists of six branches, and is characterised by two maxima at 570° and 799°, corresponding with the compounds Mg_2Cu and $MgCu_2$, and by three eutectic points at 480° and 16 at. % Cu, 555° and 41·5 at. % Cu, and 725° and 78 at. % Cu. Neither the metals nor the compounds form solid solutions. The eutectic and melting points observed by Boudouard (Abstr., 1903, ii, 78, 480) differ from those given here, it is also improbable that there is such a compound as MgCu (compare Guillet, Abstr., 1905, ii, 712). Photographs of the microstructure of various alloys are given and agree completely with the results deduced from the freezing-point curve. Z. K.

Heat Treatment of Copper-Zinc Alloys. GUY D. BENGOUGH and O. F. HUDSON (*J. Soc. Chem. Ind.*, 1908, **27**, 43—52).—An alloy containing 60·43% of copper and 39·21% of zinc (Muntz metal) was cast and hard-rolled, and the effect of annealing on the structure and properties was studied. The relations of the α and β solid solutions were found to be in agreement with Shepherd's diagram (Abstr., 1904, ii, 662). By coating fractured surfaces with electrolytic copper and cutting sections, it was found that the fracture passes by preference through the β areas, but the mineralogical hardness of the two constituents is about the same. C. H. D.

Alloys of Copper with Cobalt, Iron, Manganese, and Magnesium. R. SAHMEN (*Zeitsch. anorg. Chem.*, 1908, **57**, 1—33).—The investigation was carried out by Tammann's method of thermal analysis, controlled by microscopic observations. All the pairs of metals are completely miscible in the fused state. Only magnesium and copper enter into chemical combination, forming the compounds Cu_2Mg, m. p. 797°, and $CuMg_2$, m. p. 570°.

Copper-Cobalt Alloys.—These metals form two series of mixed crystals, from 0—10% and 95·5—100% by weight of copper respectively. There is a break in the cooling curve at 1100° from 10—95% copper, below which the alloy completely solidifies to a conglomerate of the two series of mixed crystals.

On cooling, β-cobalt, which is non-magnetic, changes to magnetic α-cobalt. The transition temperature is lowered from 1115° (for pure cobalt) to 1050° by the addition of 10% of copper, remains constant at 1050° up to 90% of copper, and then falls with further addition of copper. Alloys containing 99% of copper are still magnetic.

Copper-Iron Alloys (compare Pfeiffer, Abstr., 1906, ii, 358).—The cast-iron employed contained less than 0·3% of impurities. The equilibrium diagram is very similar to that for copper-cobalt alloys. There are two series of mixed crystals, from 0—3·5% and 97·3—100% by weight of copper respectively. There is a break in the cooling curve from 3—97% of copper, below which the alloy is completely solidified to a conglomerate of mixed crystals.

The transition from γ- to β-iron has been followed thermally. By the gradual addition of copper up to 4% (saturated mixed crystals), it is lowered from 878° to 715°, and remains constant on further addition of copper. If, however, the solidified alloy is heated for some time at 900° to 1000° and again cooled, the transition takes place at 790°. The change from β- to α-iron has been followed by magnetic observations. It occurs about 790°, and is not influenced by the presence of copper, so that the latter is not miscible in the solid state with α-iron.

The colour of the polished surface of the alloys varies gradually from red to grey as the proportion of iron increases. The tensile strength of the alloys was not determined.

Copper-Manganese Alloys (compare Schemtschuschny, Urasoff, and Rykowski (Abstr., 1907, ii, 777).—The freezing-point curve of these alloys falls from the melting points of both metals, and has a minimum at 866° and 65% by weight of copper. The deduction, from the form of the curve, that the metals form a continuous series of mixed crystals is confirmed by microscopic observations, but the alloys only become completely homogeneous when heated for some time below their melting point.

All the alloys up to 80% of copper are grey in colour. The alloy containing 2% of copper is about as hard as manganese, with further increase of the former metal they become softer, and between 10% and 100% of copper are not much harder than that metal.

Copper-Magnesium Alloys (compare Boudouard, Abstr., 1903, ii, 78, 480).—The freezing-point curve shows two maxima, at 797° and 33·3 atom. % and 570° and 66·7 atom. % of magnesium respectively, corresponding with the compounds Cu_2Mg and $CuMg_2$, and three eutectic points, at 730° and 21·5 atom. %, 555° and 56 atom. %, and 465° and 85 atom. % of magnesium respectively.

On the etched surface of the alloys, the compound Cu_2Mg appears as polygonal crystals, and $CuMg_2$ in long, rod-shaped crystals. Both compounds are very brittle and of the same colour as magnesium.

The author's results differ in several respects from those of Boudouard (*loc. cit.*). The paper is illustrated by 17 photomicrographs.

G. S.

Ammonio-cuprous Sulphate. ALBERT BOUZAT (*Compt. rend.*, 1908, **146**, 75—77).—Ammonio-cuprous sulphate, $Cu_2SO_4,4NH_3$ (compare Joannis, Abstr., 1898, ii, 221; 1903, ii, 371; 1904, i, 644; Péchard, Abstr., 1903, ii, 293; Foerster and Blankenberg, Abstr., 1907, ii, 89), is precipitated as a white, crystalline powder on the addition of alcohol to a solution of cuprous oxide and ammonium sulphate in aqueous ammonia at 50° in an atmosphere of hydrogen. Ammoniacal cuprous oxide, like the corresponding cupric compound (Abstr., 1902, ii, 490, 550), is therefore a sufficiently strong base to displace ammonium from its salts.

M. A. W.

Interaction of Mercury with Alloys of other Metals. JOHN W. MALLET (*Proc. Roy. Soc.*, 1908, **80**, *A*, 83—87).—The action of mercury on certain alloys at the ordinary temperature has been examined. An alloy of tin and platinum, corresponding with the formula Sn_2Pt, is not acted on by mercury, but if a very small quantity of sodium is added to the mercury, amalgamation takes place at once. The soft amalgam was strained by squeezing it through chamois leather and the fluid portion found to contain very small quantities of both platinum and tin. A silver platinum alloy, corresponding with the formula Ag_4Pt, amalgamates with mercury. The fluid obtained by squeezing through chamois leather contains both silver and platinum, but the proportion of silver is greater than in the solid alloy. A copper-tin alloy, corresponding approximately with the formula Cu_4Sn, amalgamates very slowly with mercury, and the strained fluid contains only very small quantities of the two metals.

The experiments show that platinum prevents the amalgamation of tin, that silver causes platinum to pass into solution, and that by alloying copper and tin, the readiness and extent with which they unite with mercury, when separately exposed to its action, is greatly diminished. H. M. D.

Dissociation by Water of the Double Chlorides of Ammonium and Dimercuriammonium. H. GAUDECHON (*Compt. rend.*, 1908, **146**, 177—180).—The decomposition of the double chlorides, Hg_2NCl,NH_4Cl (Rammelsberg and Pesci) and

$$Hg_2NCl,3NH_4Cl$$

("white precipitate"), by water at the ordinary temperature is limited by the concentration of the ammonium chloride. The equation:

$$Hg_2NCl,NH_4Cl\text{ (solid)} + H_2O \rightleftarrows Hg_2NCl,H_2O\text{ (solid)} + NH_4Cl\text{ (dissolved)} \quad (1),$$

comprising three components in four phases, constitutes a univariant system. At 15°, the concentration of the liquid phase in equilibrium is 0·011 molecule of NH_4Cl per 100 molecules of water, whilst at 27° the concentration is 0·20. This increase in the decomposition is in accordance with the law of the displacement of equilibrium with variations in temperature, and it is shown that ammonium chloride combines with Hg_2NCl,H_2O with a notable development of heat. The decomposition of $Hg_2NCl,3NH_4Cl$ by water also constitutes an univariant system: $NHg_2Cl,3NH_4Cl\text{ (solid)} \rightleftarrows Hg_2NCl,NH_4Cl\text{ (solid)} + NH_4Cl\text{ (dissolved)}$ (2). At 14°, the concentration of the liquid phase in equilibrium is 0·65 molecule per 100 molecules of water, and at 27° the concentration has increased to 0·84 molecule, which again agrees with the law of displacement of equilibrium, and the constant concentration at a given temperature establishes the non-existence of the compound $Hg_2NCl,2NH_4Cl$. In the system (1) there is only a trace of mercury in solution, but in the system (2) the liquid contains a small quantity of the metal as Hg_2NCl or its compounds with NH_4Cl. At 15°, the compound $Hg_2NCl,3NH_4Cl$ does not combine further with ammonium chloride.

At 100°, the decomposition of the two chlorides proceeds according to reactions which are the converse of those representing their formation, thus:

$$Hg_2NCl + 3NH_4Cl = 2HgCl_2 + 4NH_3 \quad . \quad . \quad (3)$$
$$2Hg_2NCl,H_2O + 2H_2O = 2NH_3 + HgCl_2 + 3HgO \quad . \quad (4)$$

The reactions are really more complicated, it being necessary to dissolve the chlorides in ammonium chloride solution, but the quantities of ammonia, mercuric chloride, and mercuric oxide here represented are actually produced.

The conclusions are drawn that at the ordinary temperature in the presence of water the two chlorides behave as true double salts, although combination of NH_4Cl with Hg_2NCl to form Hg_2NCl,NH_4Cl develops an unusually large amount of heat, and that in presence of boiling water the radicle Hg_2N tends to re-form its generators, ammonia, mercuric chloride, and mercuric oxide. E. H.

Neo-Erbium. Karl A. Hofmann and O. Burger (*Ber.*, 1908, **41**, 308—312).—Neo-erbium oxide, prepared by Wilson and Cleve's method, contains thulium, holmium, and dysprosium as impurities. Fractional precipitation with aniline hydrochloride (Krüss, Abstr., 1903, i, 376) is of no value for purification, as the holmium cannot be removed by this process. The methods adopted were (1) treatment of the salts with concentrated potassium sulphate solution, (2) evaporation to dryness with excess of sodium nitrite and extraction with water, when most of the erbium hydroxide is insoluble, (3) crystallisation of the formates, (4) gradual fractional precipitation with dilute ammonia, (5) Urbain's method of crystallising the ethyl sulphate (Abstr., 1900, ii, 346 ; 1906, ii, 360).

Welsbach's method of crystallising the double oxalate (this vol., i, 26) is very effective for separating holmium and erbium.

The purified material appeared to be homogeneous, and repeated purification did not alter it. The atomic weight determined by the sulphate method, using Brauner's precautions (Trans., 1902, **81**, 1243) was found to be 167·43 (four determinations, $O=16$, $S=32{\cdot}06$). The absorption spectrum of a 10% nitrate solution has bands λ 653, 523, 487, 450, 442. J. J. S.

Some Compounds of Terbium and of Dysprosium. Georges Urbain and G. Jantsch (*Compt. rend.*, 1908, **146**, 127—129).—*Terbium peroxide* has a composition corresponding exactly with the formula Tb_4O_7 so long as too high a temperature has been avoided in its preparation by calcination of a terbium salt. The peroxide loses oxygen at a white heat, and consequently the composition of the product of calcining the sulphate at 1600° contains a variable quantity of oxygen, as estimated by dissolving in a sulphuric acid solution of ammonium ferrous sulphate and determining the excess of the latter by permanganate. Terbium peroxide dissolves in nitric acid diluted with a small quantity of water (8 : 1), giving colourless, monoclinic needles of *terbium nitrate*, $Tb(NO_3)_3,6H_2O$, which give an aqueous solution neutral to litmus, and when heated in a sealed tube melt in their water of crystallisation at 89·3°. Terbium sulphate,

$$Tb_2(SO_4)_3,8H_2O$$

(Urbain, Abstr., 1905, ii, 711), is also obtained as a crystalline powder of micaceous lamellæ by precipitation of a solution of terbium containing sulphuric acid by alcohol. *Terbium chloride*, $TbCl_3,6H_2O$, formed by dissolution of the peroxide in hydrochloric acid, forms colourless, transparent, prismatic crystals, which are extremely hygroscopic and give an aqueous solution neutral to litmus.

Dysprosium does not form a peroxide, the oxide, Dy_2O_3, remains unchanged when heated in either an oxidising or a reducing atmosphere. Under the conditions in which the hexahydrated terbium nitrate is formed, dysprosium gives the pentahydrated *dysprosium nitrate*, $Dy(NO_3),5H_2O$, resembling bismuth nitrate. This loses water in a dry atmosphere, gives a neutral aqueous solution, and has m. p. 88·6° (in water of crystallisation). Dysprosium sulphate, $Dy_2(SO_4)_3,8H_2O$ (Urbain and Demenitroux, Abstr., 1906, ii, 855), closely resembles the terbium salt. *Dysprosium chloride*, $DyCl_3,6H_2O$, is prepared similarly to the terbium chloride, to which it is analogous, but is less deliquescent. E. H.

Bromates of the Rare Earths. I. New Method for the Separation of the Yttrium Earths. CHARLES JAMES (*Chem. News*, 1908, **97**, 61—62. Compare Abstr., 1907, ii, 467).—The author briefly points out the disadvantages of the methods for the separation of the yttrium earths employed by Urbain (Abstr., 1898, ii, 518; 1899, ii, 28; 1901, ii, 160), Demarçay (Abstr., 1896, ii, 475; 1900, ii, 347), von Welsbach (Abstr., 1907, ii, 26), Muthmann and Rolig (Abstr., 1898, ii, 518), and Muthmann and Böhm (Abstr., 1900, ii, 209), and, after examining the solubilities of the salts of a large number of inorganic and organic acids, recommends the fractional crystallisation of the bromates.

The rare earth material, generally in the form of the oxalates, is made into a paste with concentrated sulphuric acid, and heated until fumes cease to be evolved. The residue is powdered, dissolved in water at 0°, and the solution poured over an excess of barium bromate, the operation being performed on the water-bath with efficient stirring. When the double decomposition is completed, the filtered liquid is evaporated to such a concentration that about half the substance in solution crystallises out on cooling.

After six series of crystallisations, the spectroscope shows that a separation is being effected. After twenty operations, the least soluble fraction is colourless and consists mainly of yttrium bromate the absorption spectrum showing, however, that some dysprosium, and in a smaller degree, samarium and holmium are present. The brown colour of the oxide also indicates that terbium collects in this fraction. The more soluble fractions become yellower, those exhibiting the strongest colour showing very intense bands of dysprosium and holmium. Succeeding fractions attain a rose pink colour, and show only erbium bands. Then thulium begins to appear, and finally the most soluble fraction is reached, consisting largely of ytterbium.

The bromates of the rare earths arrange themselves in the following order of increasing solubility: samarium (europium ?, gadolinium ?), terbium, yttrium, dysprosium, holmium, erbium, thulium, and ytterbium. This order is not quite the same as that of the ethyl sulphates; the bromate method, in conjunction with Urbain's, should prove very valuable for the separation of yttrium from dysprosium and holmium, and possibly of thulium from ytterbium. C. S.

Action of Finely-divided Metals on Water. WILLEM VAN RYN (*Chem. Weekblad*, 1908, **5**, 1—5. Compare Birnie, Abstr., 1907, ii, 469).—The author has investigated the action of finely-divided aluminium, zinc, magnesium, nickel, copper, and lead on pure distilled water at the ordinary temperature and at 100°. The lead and nickel were obtained by reduction of the oxalates in a current of hydrogen, and the copper by reduction of cuprous oxide. The oxalates of the other metals could not be reduced, so that finely-powdered commercial samples were employed.

Aluminium has no action on cold or boiling water, but addition of a small quantity of mercury produces an evolution of hydrogen which is increased by heat. Zinc decomposes cold water slowly, boiling water rapidly, the presence of mercury producing no effect. Magnesium resembles zinc, but addition of mercury causes a greater evolution of hydrogen than with aluminium. Nickel, copper, and lead, with or without mercury, do not liberate hydrogen at temperatures up to 100°.

A. J. W.

Formation of Certain Precious Stones of the Family of the Aluminides. FRÉD. BORDAS (*Compt. rend.*, 1908, **146**, 21—24. Compare Abstr., 1907, ii, 956; this vol., ii, 8).—When a yellow corundum artificially coloured by the action of radium bromide is heated on a bath of a lead-tin alloy, maintained constant at 300° by means of a Schlœsing regulator, the colour becomes paler at the end of three hours, and after four hours the stone regains its original colour and transparency. A similar result is obtained with an oriental topaz, the yellow colour disappearing. If a sapphire is exposed to the action of radium, it gradually becomes green, usually a disagreeable cabbage-green colour, but by careful heating as above it can be converted to the beautiful green of the oriental emerald. The conclusion is drawn that oriental topazes were not coloured at the time of their formation, but became yellow subsequently by the radioactivity of the sun, and that an oriental emerald is simply a sapphire in which the blue colour has been exactly neutralised by the yellow resulting from the same radioactive influence.

By means of a modification of the apparatus described by d'Arsonval and Bordas (*Compt. rend.*, 1906, **143**, 567), in which precautions are observed to prevent a rise in temperature of the stone treated, the author has submitted corundums to the cathodic rays, and finds that the colourless stones do not become yellow, whilst the yellow corundum retains its colour. Thus the cathodic rays, like the β-rays from radium and unlike the X-rays, have no action on corundum.

E. H.

Dissociation Temperatures of Manganese Dioxide (MnO_2) and Dimanganese Trioxide (Mn_2O_3) in Air and Oxygen. RICHARD J. MEYER and KURT RÖTGERS (*Zeitsch. anorg. Chem.*, 1908, **57**, 104—112).—Pure manganese dioxide was prepared by prolonged heating of the nitrate at 500°. The experiments were made in an electric furnace, the chemical changes being followed by weighing and also by estimating the products iodometrically.

The change $MnO_2 \longrightarrow Mn_2O_3$ begins in air at 530°, and is complete (under the conditions of the experiment) in eighty-six hours; the change $Mn_2O_3 \longrightarrow Mn_3O_4$ begins about 940°, and is complete in twelve hours. The oxide, Mn_3O_4, is stable in air up to 1300°, and does not re-absorb oxygen from the air on cooling. In dry oxygen at atmospheric pressure, the reaction $MnO_2 \rightarrow Mn_2O_3$ begins at 565°, and the reaction $Mn_2O_3 \rightarrow Mn_3O_4$ at 1090°. In oxygen at 650—900°, the tetroxide is reconverted into the oxide, Mn_2O_3. G. S.

Spontaneous Combustion of Manganese Sulphide. O. Binder (*Zeitsch. anal. Chem.*, 1908, **47**, 144).—A precipitate of hydrated manganese sulphide, placed in a watch-glass and covered over with a larger one, was found to have become ignited in two or three places. The space between the glasses was filled with fumes.

L. de K.

Constitution of Cast-irons containing Manganese. Léon Guillet (*Compt. rend.*, 1908, **146**, 74—75).—The chemical and micrographical examination of an extensive series of white cast-irons containing increasing quantities of manganese (0·86% to 42·22%) shows that, contrary to the conclusion drawn from earlier experiments (Abstr., 1907, ii, 875), γ-iron is present in cast-irons containing high percentages of manganese, and these also contain a carbide. The cast-iron containing 3·6% of carbon and 15% of manganese, when cooled sufficiently slowly, consists of the pure eutectic mixture carbide-γ-iron. The addition of manganese to a grey cast-iron causes the production of γ-iron before the graphite has disappeared. M. A. W.

Iron Sulphide. Hans Malfatti (*Zeitsch. anal. Chem.*, 1908, **47**, 133—140).—Experiments showing that the precipitate formed in ferric iron solutions by ammonia and ammonium sulphide is a ferric compound. So long as the supernatant liquid contains not less than 0·5% of NH_3, the precipitate consists of the compound FeS_2NH_4. On adding ammonium chloride, or by prolonged washing with water, the ammonia is removed and Fe_2S_3 is left behind. The same substance is formed by the action of hydrogen sulphide on ferric hydroxide.

L. de K.

The Reducing and Oxidising Power of Salts of Iron. Erich Müller and Friedrich Kapeller (*Zeitsch. Elektrochem.*, 1908, **14**, 76—82).—The reducing power of a solution containing ferrous and ferric ions increases with the ratio $Fe^{\cdot\cdot}/Fe^{\cdot\cdot\cdot}$. Three examples of this are studied: (1) Atmospheric oxygen does not oxidise an acid solution of ferrous sulphate, but is quickly absorbed if an alkali is added. In the former, the ratio cannot much exceed 10^3, whereas in presence of normal alkali it is $1{\cdot}5 \times 10^{22}$, owing to the greater solubility of ferrous hydroxide. (2) Solutions of ferrous and cupric sulphates do not react, but cuprous oxide is precipitated if potassium fluoride is added to the neutral mixture, and metallic copper if it is added to the acid solution. In this case, the ratio is increased by the conversion of ferric ions into complex ions containing iron and fluorine. In neutral solution, the cuprous ions produced by the reduction separate as hydroxide, whilst in acid solution, owing to the higher concentration reached, they yield metallic copper and cupric ions. (3) The oxidation of hydriodic acid to iodine by ferric ions, $2I' + 2Fe^{\cdot\cdot\cdot} = I_2 + 2Fe^{\cdot\cdot}$, is reversed by the addition of potassium fluoride, the explanation being the same as that given above. T. E.

Some Complex Iron Salts in which the Iron is Masked. P. Pascal (*Compt. rend.*, 1908, **146**, 231—233).—The solubility of ferric pyrophosphate in the corresponding sodium salt is due to the formation of a new complex salt, $Fe_4(P_2O_7)_3, 3Na_4P_2O_7$, or

$$Na_6Fe_2(P_2O_7)_3,$$

analogous to the ferricyanides, for which it is suggested that the name *ferripyrophosphate* be reserved.

Sodium ferripyrophosphate, $Na_6Fe_2(P_2O_7)_3,9H_2O$, is slowly deposited as a pale violet, microcrystalline precipitate at 30° from a 15% solution of sodium pyrophosphate, saturated with ferric pyrophosphate, and yields by double decomposition the *silver* salt, $Ag_6Fe_2(P_2O_7)_3,4H_2O$, which is greenish-yellow, or the *copper* salt, $Cu_3Fe_2(P_2O_7)_3,12H_2O$, which is greenish-blue. The complex *acid*, $H_6Fe_2(P_2O_7)_3,7H_2O$, is obtained as a white solid when ferric pyrophosphate is heated for twelve hours at 50° with two-thirds of its weight of syrupy pyrophosphoric acid dissolved in acetone.

By similar methods, the author has prepared *sodium ferropyrophosphate*, $Na_8Fe_2(P_2O_7)_3$, the corresponding *ferro-* and *ferri-metaphosphates*, $Na_4Fe(PO_3)_6$ and $Na_3Fe(PO_3)_6$, and also the corresponding salts, in which the iron is replaced by cobalt, chromium, or nickel. M. A. W.

A New Series of Ammonio-ferric Salts in which the Iron is Masked. P. Pascal (*Compt. rend.*, 1908, **146**, 279—282).—Addition of ammonia to a ferripyrophosphate solution (preceding abstract) does not precipitate ferric hydroxide, but colours the solution reddish-yellow. When ammonia (29° Baumé) is added to the solution at 10°, obtained by mixing 15% solutions of sodium pyrophosphate and ferric chloride, the liquid is coloured red, and there are produced (1) a crystalline precipitate equal to one-third of the sodium pyrophosphate used; (2) at the junction of the two liquids initially separate, a layer of red clots surmounted by one of yellow, and (3) in the upper layer of the liquid, a mass of long, felted, silky needles. All three compounds are ammonio-ferric salts, in which the iron is masked. The compound (1) contains sodium pyrophosphate which has carried down with it varying proportions of ammonia and iron, the ratio between the quantities of the two latter having one of two values. When much ammonia is present, the precipitate consists of short, thick, orange-coloured needles, containing iron and ammonia, in the ratio $Fe : NH_3 = 1 : 1{\cdot}5$. It can be represented as a combination of sodium pyrophosphate and ammoniacal ferripyrophosphate, thus:

$$n(Na_4P_2O_7,10H_2O),Na_6Fe_2(P_2O_7)_6,3NH_3,pH_2O.$$

Values are obtained for n 4, 2·5, and 18, and for p 8, 15, and 25. On the other hand, in the presence of but little ammonia, the precipitate is composed of small, rectangular, yellow plates, often having broken corners. In these, the ratio $Fe : NH_3$ equals unity, and their constitution is represented by

$$n(Na_4P_2O_7,10H_2O),Na_6Fe_2(P_2O_7)_8,2NH_3,pH_2O,$$

the values found for n being 18 and 9, and for p 50 and 60.

When removed from the liquid and exposed to the air, the red clots (2) liquefy, becoming deep violet-red in colour, and losing water and ammonia. If dried in an atmosphere of dilute ammonia, which prevents dissociation, they have a composition corresponding with $Fe_4(P_2O_7)_3,2Na_4P_2O_7,4NH_3,68H_2O$. The substance dissolves in water to a red solution, which is alkaline towards phenolphthalein, gives a rusty precipitate with silver salts, but does not exhibit the characteristics of ferric salts except towards ammonium hydrosulphide. On prolonged contact with dry air, the salt loses water and ammonia, and is transformed into a brick-red powder of the formula

$$5[Fe_4(P_2O_7)_3,2Na_4P_2O_7],4NH_3,160H_2O,$$

the iron still being masked.

When the red liquid, obtained by adding ammonia to the ferripyrophosphate solution, is slowly evaporated, a precipitate is formed in two layers, the upper one being red, and the lower yellow. The latter is a very easily dissociated ammoniacal derivative, the former, however, is a stable compound of the composition $Fe_4(P_2O_7)_3,8NH_3,32H_2O$, which dissolves in water to a neutral solution, giving a pale yellow precipitate with silver salts. All the constituent radicles of this salt seem to be masked.

These new derivatives may be members of series having the general formulæ: I $[Fe_4(NH_3)_{24-4p}(P_2O_7)_p](P_2O_7)_{3-p}$ and

$$\text{II } [Fe_4(NH_3)_{12-4q}(P_2O_7)_{3+q}]R_{4q},$$

comparable to the cobaltammines. Ferriphosphates have been prepared having the formula II in which $q = 3$, whilst the red clots correspond with the same formula when $q = 2$. E. H.

Alloys of Nickel with Tin, Lead, Thallium, Bismuth, Chromium, Magnesium, Zinc, and Cadmium. G. Voss (*Zeitsch. anorg. Chem.*, 1908, **57**, 34—71).—The thermal and microscopic examination of the alloys mentioned in the title show that the following compounds exist: Ni_3Sn_2, Ni_3Sn, Ni_4Sn; $NiBi$, $NiBi_3$; Ni_2Mg, $NiMg_2$; $NiZn_3$; $NiCd_4$. Nickel does not enter into chemical combination with lead, thallium, or chromium. The magnetic properties of the alloys have also been investigated.

Nickel-Tin Alloys (compare Gautier, *Bull. Soc. Encour.*, 1896, i, 1293; Heycock and Neville, Trans., 1890, **57**, 376).—The behaviour of these metals is remarkable, inasmuch as they separate into two layers in the fused state from 3·5—18% and 26—45% of nickel. There are no distinct maxima on the freezing-point curve, but there are three breaks and two eutectic points, at 1135° and 68·5% and 229° and 1·3% of nickel respectively.

Between 30% and 45% nickel, the two liquid layers react at 1262° to form the compound Ni_3Sn_2.

A break in the cooling curve at 1162° corresponds with the formation of the compound Ni_3Sn (long needles) from the compound Ni_3Sn_2 and a fused mass containing 65% of nickel. Between 60% and 85% nickel, there is a break in the cooling curve at 855°, due to the formation of the compound Ni_4Sn by interaction of Ni_3Sn and the mixed crystals. From 42·5—60% of nickel, a slight thermal effect at 837° (sometimes lower owing to supercooling) appears to indicate the breaking down of the compound Ni_3Sn into Ni_3Sn_2 and Ni_4Sn. There is one series of mixed crystals from 0—15% of tin.

Only alloys up to 60% of nickel are magnetic. The temperature at which the magnetic property disappears on heating falls from 350° for pure nickel to 145° for 62% of that metal. From 67—65% of nickel, the fall is 60° (190°—130°), corresponding with the disappearance of the mixed crystals.

Nickel-Lead Alloys.—These alloys are not miscible in the fused state between 16% and 72% of nickel. There is a series of mixed crystals which, when saturated, contain 4% of lead; at 1338°, these are in equilibrium with the two liquid layers. The solubility of the mixed crystals in lead decreases very rapidly with fall of temperature, and at its melting point pure lead separates.

All the alloys are magnetic. The transition temperature of non-magnetic to magnetic nickel is raised about 5° by the addition of 4% of lead, and remains constant at 350° on further addition of lead.

Nickel-Thallium Alloys.—These metals are not miscible in the fused state from 0—90% of nickel. Nickel retains in solid solution up to about 3% of thallium; these mixed crystals are in equilibrium at 1386° with the two liquid layers. The transition temperature of non-magnetic to magnetic nickel is lowered 15° by the addition of sufficient thallium to form the saturated mixed crystals, and remains constant on further addition.

Nickel-Bismuth Alloys.—These metals are completely miscible in the fused state. The freezing-point curve consists of three branches, without maxima or minima. There is one series of mixed crystals containing up to 0·5% of bismuth. At 638°, the saturated mixed crystals react with a fused mass containing 32% of nickel to form the compound NiBi; the latter reacts at 472° with the fused mass containing 11% of nickel to form a second compound, $NiBi_3$. These compounds could not be obtained pure, even on prolonged heating in the neighbourhood of their temperatures of formation.

The transition temperature of magnetic to non-magnetic nickel is lowered 20° by the addition of sufficient bismuth to form the saturated mixed crystals, and then remains constant at 325° up to a composition of 32% of nickel, beyond which point the alloys are no longer magnetic.

Nickel-Chromium Alloys.—The freezing-point curve of these alloys consists of practically two branches; from 0—42% of nickel, mixed crystals, rich in chromium, separate, and from 42·5—100% of nickel mixed crystals rich in the latter metal. There is a very short break in the miscibility from about 42·0% to 42·5% of nickel.

Alloys containing less than 90% of nickel are non-magnetic. The transition temperature is lowered 100° by the addition of 2% of chromium.

Nickel-Magnesium Alloys.—These metals are completely miscible in the fused state. The freezing-point curve shows a flattened part (not a true maximum) at 1145° from 75—83% nickel, which, from other indications, corresponds with the compound Ni_2Mg (thin leaflets), two eutectic points at 1082° and 89% nickel (nickel and Ni_2Mg) and 512° and 34% nickel ($NiMg_2$ and magnesium) respectively, and a break at 768°. At the latter temperature, Ni_2Mg and the fused mass containing about 45% of nickel react to form the second compound, $NiMg_2$.

The magnetic transition temperature of nickel at 350° is not altered by the addition of 17% of magnesium. From 83—55% of nickel, the transition takes place at 235°, and alloys containing less than 55% are not magnetic.

Nickel-Zinc Alloys (compare Heycock and Neville, Trans., 1897, **71**, 383).—Only alloys up to 23% of nickel were investigated. From 14·5—23% of nickel, mixed crystals of a compound, $NiZn_3$, and zinc separate, but between 0% and 14·5% of nickel these mixed crystals are insoluble in zinc. These results agree well with those of Tafel (this vol., ii, 105), except that the latter found the saturation point of the mixed crystals at 12·5% of nickel.

At room temperature, these alloys were non-magnetic.

Nickel-Cadmium Alloys.—Owing to the volatility of cadmium, these alloys could only be investigated up to 15% of nickel. At 501°, a compound of unknown composition reacts with the fused mass to form a compound, $NiCd_4$. Nickel is insoluble in solid cadmium at the melting point of the latter.

The alloys with zinc and cadmium are not magnetic.

The paper is illustrated by thirty-four photomicrographs. G. S.

Sulphide Compounds of Nickel and Cobalt. Italo Bellucci and Lilio Bellucci (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 18—29).—By fusing at a high temperature a mixture of a nickel salt with sulphur and an alkali, the crystalline double sulphides, $3NiS,K_2S$ and $4NiS,BaS$, may be obtained. Under similar conditions, cobalt salts yield only the sesquisulphide, Co_2S_3; in one case, in which the mixture was kept at a white-red heat for a long period, a crystalline product, approximating in composition to Co_3S_4, was obtained. Thus nickel behaves analogously to its homologues palladium and platinum, whilst the sulphur compounds of cobalt, in which the tervalent type predominates, are in accord with those of rhodium and iridium. These facts confirm the position of nickel in the periodic system after cobalt and before copper. T. H. P.

Chromic Acid as an Oxidising Agent. II. Karl Seubert and J. Carstens (*Zeitsch. anorg. Chem.*, 1908, **56**, 357—364. Compare Abstr., 1906, ii, 617).—In dilute hydrochloric acid solution, hydrazine is oxidised quantitatively by chromic acid to nitrogen and water. The chemical dynamics of the reaction have been investigated at 20°, its progress being followed by withdrawing a portion of the mixture from time to time, mixing with acidified potassium iodide solution, and titrating the iodine liberated with thiosulphate.

The reaction is extremely rapid; in a solution 1/8000 and 1/16000 molar with regard to hydrazine and chromic acid respectively, and 1/200 molar with regard to hydrochloric acid, it is complete in about an hour. The rate is proportional to the concentrations of chromic acid and hydrazine respectively in the presence of excess of hydrochloric acid, and is also proportional to the concentration of the latter. The mechanism of the reaction cannot be fully elucidated, owing to the want of knowledge of the constitution of chromate solutions, but the ionic equation $Cr_2O_7'' + N_2H_5^{\cdot} = 2CrO_2 + N_2 + 2H_2O + OH'$ is in agreement with the kinetic measurements. G. S.

The Hydrolysis of Ammonium Molybdate in the Presence of Iodides and Iodates. SETH E. MOODY (*Amer. J. Sci.*, 1908, [iv], **25**, 76—78. Compare Glasmann, Abstr., 1905, ii, 209).—Ammonium molybdate is completely hydrolysed in presence of potassium iodide and potassium iodate, iodine being liberated according to the equations: $3(NH_4)_6Mo_7O_{24},4H_2O = 18NH_3 + 21H_2MoO_4$;

$$21H_2MoO_4 + 35KI + 7KIO_3 = 21K_2MoO_4 + 21I_2 + 21H_2O.$$

On distilling, the free ammonia acts on three-sevenths of the iodine unless prevented by acidifying. The decomposition of ammonium molybdate is not a partial one as supposed by Glasmann.

R. J. C.

Preparation of Silicotungstic Acids. HIPPOLYTE COPAUX (*Bull. Soc. chim.*, 1908, [iv], **3**, 101—109).—Marignac described three acids of this type, namely, silicotungstic acid, $12WO_3,SiO_2,2H_2O + 31H_2O$, in quadratic crystals; tungstosilicic acid, $12WO_3,SiO_2,2H_2O + 22H_2O$, in triclinic crystals, and silicodecitungstic acid, $10WO_3,SiO_2,4H_2O + 3H_2O$, amorphous and unstable. The present paper deals mainly with methods of preparing these substances.

Three methods are available for the preparation of silicotungstic acid, and the simplest and most expeditious consists in treating sodium tungstate with sodium silicate in presence of acetic acid.

Tungstosilicic acid may be most easily made by adding sodium silicate to a faintly acid solution of sodium tungstate, making the mixture slightly acid with sulphuric acid, and heating at 100° until, on adding sulphuric acid and ether, oily drops separate. In addition to tungstosilicic acid, some silicotungstic acid is formed, and the two may be separated by fractional crystallisation of the potassium salts, the silicotungstate separating first. Both salts are isomorphous, similarly hydrated, have the same electrical conductivity, and may be equally well used as alkaloidal reagents. Contrary to Marignac's statement, potassium tungstosilicate slowly passes into the silicotungstate when heated with water in a closed vessel at 150°.

A slight improvement in Marignac's method of preparing silicodecitungstic acid may be effected by adding ammonia in great excess to a solution of silicotungstic acid and boiling the mixture, the latter being shaken constantly. The ammonium salt so obtained crystallises in orthorhombic prisms, and on solution in water and evaporation yields the required acid. The methods employed for the analysis of these substances have been described already (compare Copaux, Abstr., 1906, ii, 170, Friedheim, Henderson and Pinagel, Abstr., 1905, ii, 614).

T. A. H.

Heterogeneous Colloidal Hydroxides of Uranyl, Thorium, Zirconium, Lead, Yttrium, Iron, and Copper. BÉLA SZILARD (*J. Chim. phys.*, 1907, **5**, 636—646).—Colloidal solutions are often prepared by dissolving an insoluble hydroxide in a solution of a salt with a common ion. The author has modified the method by employing hydroxides and electrolytes without a common ion, and terms the products heterogeneous colloids.

Such colloids containing thorium, lead, zirconium, and uranyl have been prepared, and their properties are described. Isomeric colloids of different behaviour, prepared, for example, from thorium hydroxide and uranyl nitrate on the one hand, and from thorium nitrate and uranyl hydroxide on the other, are of particular interest.

In these colloids, it is not, in general, possible to displace one component by another directly. They do not give the ordinary chemical reactions for the elements present, but a colloid containing lead was found not to be typical in this respect, as it gives the reactions for the metal. G. S.

Stannic Acids. Hugo Kühl (*Pharm. Zeit.*, 1908, **53**, 49).—The stannic acid obtained by treating a hot solution of sodium stannate with sulphuric acid, when freshly prepared, is completely soluble in 5% hydrochloric acid and concentrated sulphuric acid; the solution in the latter deposits prismatic crystals when heated. The stannic acid, kept as a paste for ten days, is soluble in 5% hydrochloric acid only on boiling, and is only partly soluble in concentrated sulphuric acid; the insoluble gelatinous portion is not completely soluble in strong hydrochloric acid, neither is the gelatinous stannic acid precipitated on heating the sulphuric acid solution.

The stannic acid, obtained by carefully adding dilute sulphuric acid to a cold solution of sodium stannate when freshly prepared, is readily soluble in 2% hydrochloric acid and strong sulphuric acid; the solution in sulphuric acid gives no deposit when heated. The acid loses its solubility in sulphuric acid, but not in hydrochloric acid, when kept for some time in a pasty condition.

The stannic acid, obtained from a freshly prepared solution of sodium stannate, is readily soluble in 2% hydrochloric acid and 2% potassium hydroxide, whereas that obtained from the same solution after being kept for twelve days is not soluble in solutions containing less than 6% of potassium hydroxide and 5% of hydrogen chloride. W. H. G.

So-called Amorphous Antimony. Ernst Cohen and J. Olie (*Zeitsch. physikal. Chem.*, 1908, **61**, 588—595. Compare Abstr., 1904, ii, 345; 1905, ii, 170, 532).—Hérard's experiments (Abstr., 1888, 1256), on which is based the existence of amorphous antimony, are subjected to a critical examination. It is shown that when pure antimony and pure nitrogen are used, the phenomena described by Hérard are not to be observed. If, on the other hand, the nitrogen is insufficiently purified, these phenomena are reproduced. What Hérard described as "amorphous antimony" appears to be nothing else than the ordinary stable antimony contaminated with more or less trioxide. J. C. P.

Compounds of Antimony, Sulphur, and Chlorine. Herman J. Taverne (*Chem. Weekblad*, 1908, **5**, 19—28. Compare Ruff, Abstr., 1905, ii, 22; Bertrand and Finot, Abstr., 1881, 239; Ouvrard, Abstr., 1893, ii, 533; Hensgen, Abstr., 1891, 1160; and Walden, Abstr., 1901, ii, 11).—A review of previous work on compounds of antimony with sulphur and chlorine, and an account of two derivatives prepared by the author are given. When dry hydrogen sulphide is passed into a solution of antimony trichloride in dry carbon disulphide or tetrachloride, or in a mixture of these solvents, there is formed a white precipitate, which is converted by a little water into antimony trisulphide. On continued passage of hydrogen sulphide, the colour of the white compound changes to yellow, yellowish-red, orange, and finally dark red. The end-product is crystalline, and has the formula $Sb_4S_5Cl_2$. It is identical with that obtained by Ouvrard. The author gives reasons supporting the view that it results from replacement of one S-atom in two molecules of antimony trisulphide by two Cl atoms. A light orange, crystalline intermediate product, $Sb_5S_6Cl_3$, has also been isolated. A. J. W.

So-called Amorphous Bismuth. Ernst Cohen and J. Olie (*Zeitsch. physikal. Chem.*, 1908, **61**, 596—598).—The results described by Hérard (Abstr., 1889, 572) can be obtained only with imperfectly purified nitrogen. What Hérard refers to as amorphous bismuth is the ordinary form of the metal contaminated with more or less trioxide. J. C. P.

Bismuthous Compounds. II. Walter Herz and Arthur Guttmann (*Zeitsch. anorg. Chem.*, 1908, **56**, 422—428. Compare Abstr., 1907, ii, 274).—The freezing-point curve of the system bismuth trichloride-bismuth shows a maximum corresponding with the composition of bismuthous chloride, $BiCl_2$, and the formation of this compound is confirmed by the fact that its density, 4·85—4·88, is lower than that of a mixture of bismuth trichloride and bismuth of corresponding composition. It occurs in thick, lustrous, black needles, m. p. 163°; the black colour may be due to a trace of impurity.

Bismuthous bromide and the corresponding *iodide* are formed by heating the bismuthic compounds with the calculated amount of bismuth; the former occurs in greyish-black, crystalline leaflets, D 5·9, m. p. 198°, the latter in crystals with metallic lustre, D 6·5, which decompose below their melting point.

An unsuccessful attempt was made to prepare the chloride and bromide by leading the corresponding halogen acid over heated bismuthous oxide.

The authors now admit that, contrary to their previous statement and in agreement with Aten (Abstr., 1906, ii, 11), there is no evidence of the existence of bismuthous sulphide, BiS. G. S.

Chemical Decomposition of Platinum by means of an Alternating Current. Theodor Gross (*Chem. Zentr.*, 1907, ii, 1729; from *Elektrochem. Zeitsch.*, 1907, **14**, 146—147).—When potassium carbonate containing a little potassium nitrate is treated in a platinum crucible at a yellow heat with an alternating current (50 alternations per second, 120 volts, 35 amperes), the platinum is attacked and needles resembling graphite are formed on and in the fused mass. The brown residue, obtained on extracting the fusion with water, is attacked by hydrogen only with difficulty, is soluble in hot hydrochloric acid, or, after ignition, in *aqua regia*, and gives a dark brown precipitate with hydrogen sulphide. The filtrate from this, on evaporation, yields a red powder, which does not contain platinum, dissolves in hydrochloric acid, is precipitated by potassium hydroxide, and, after ignition, is soluble only when first disintegrated by means of an alkali. The needles, formed during the electrolysis, behave in the same manner as the brown residue, after solution in *aqua regia*. It is considered that the red powder is the hydrate of a new substance. After ignition, the hydrogen sulphide precipitate from the whole of the products weighs 15% less than the loss of platinum from the crucible and electrodes. Ordinary platinum cannot be detected in the electrolysed fused mass. The electrolysis of potassium hydroxide and of a mixture of nitric and sulphuric acids in platinum gives similar results. G. Y.

Rhodium. ALEXANDER GUTBIER and A. HÜTTLINGER (*Ber.*, 1908, **41**, 210—216).—The double halogen salts of rhodium described were prepared with the object of finding a material suitable for atomic weight determinations. When heated in a stream of hydrogen they all give up the halogen attached to rhodium as halogen hydride, and can therefore be analysed by the method described by Gutbier, Trenkner, and Ransohoff (*Zeitsch. anorg. Chem.*, 1905, **45**, 166, 243). *Potassium rhodipentachloride*, K_2RhCl_5,H_2O, prepared either by heating potassium chloride and rhodium in a stream of chlorine or by concentrating a solution of the components in molecular proportions, forms small, glistening, dark red plates. *Sodium rhodihexachloride*, $Na_3RhCl_6,12H_2O$, forms a rose-coloured powder. *Ammonium rhodihexachloride*, $(NH_4)_3RhCl_6,1\frac{1}{2}H_2O$, forms dark red crystals, whilst the *rhodipentachloride*, $(NH_4)_2RhCl_5,H_2O$, separates in glistening, dark red crystals.

Cæsium and *rubidium rhodipentachlorides* could not be prepared by heating cæsium or rubidium chlorides with rhodium in a stream of chlorine, but were obtained (with $1H_2O$) as sparingly soluble, brilliant, rose-coloured products by the alternative method.

The corresponding rhodibromides were obtained from the potassium salt (the only one accessible) by heating a mixture of finely-divided rhodium and the alkali bromide in a stream of bromine. *Potassium rhodipentabromide*, K_2RhBr_5, forms brilliant, dark green, irregular plates; *ammonium rhodipentabromide*, $(NH_4)_2RhBr_5$, is black with a green shade; the *cæsium* and *rubidium* compounds, which are sparingly soluble, have a brilliant green colour. E. F. A.

Mineralogical Chemistry.

Sodium Fluoride in Nepheline-Syenite from Los Islands. ALFRED LACROIX (*Compt. rend.*, 1908, **146**, 213—216).—The Los Islands, off the West Coast of Africa, are composed entirely of nepheline-syenites, which vary from fine-grained to pegmatitic in texture, and contain the following minerals: microcline, albite, nepheline, bright blue sodalite, ægirite, arfvedsonite, astrophyllite, biotite, låvenite, eudialyte, fluorite, and analcite. The analcite occurs as an original constituent in limpid masses the size of the fist. A fine-grained, grey rock from the island of Ruma is spotted with a crimson mineral, which was found to be essentially sodium fluoride (with traces of potassium, calcium, and possibly zirconium); D 2·79; $H < 3$. This new mineral, called *villiaumite*, is tetragonal and pseudo-cubic, with three perfect cleavages at right angles to one another. The refractive index ($n_{Na} = 1·328$) is lower than that of any other mineral and less than that of water; the birefringence is very feeble, and no interference-figure is seen in convergent polarised light. A striking feature is the very strong pleochroism, the colours being crimson and golden for vibrations respectively perpendicular and parallel to the vertical axis. The colour and pleochroism were thought to be possibly due to the presence of a trace of manganese, but this element could not be detected. At a red-heat, the colour is destroyed and the mineral fuses to a colourless, mobile liquid. The mineral is soluble in water, and from the solution sodium fluoride crystallises as cubes, or octahedra, with cubic cleavages, and D 2·76, $n_D = 1·327$. Boiling water extracts from the rock 0·35% of soluble salts, consisting mainly of sodium fluoride with some sodium chloride. The new mineral is present as a primary constituent of the nepheline-syenite. The minerals most closely related to it are the alkali aluminium fluorides, cryolite, cryolithionite, and chiolite. L. J. S.

Magnesium-pectolite from the Diabase of Burg, Hesse-Nassau. E. Reuning (*Centr. Min.*, 1907, 739—741).—Pectolite occurs in crevices of the diabase at Burg, near Herborn, as white masses with a radially fibrous structure. Analysis by M. Dittrich gave:

SiO_2.	Al_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	H_2O. <110°.	H_2O. >110°.	CO_2.	Cl.	Total.	Sp. gr.
54·11	0·64	24·84	5·54	6·63	0·21	1·78	5·32	0·82	trace	99·89	2·688

These results, besides showing an abnormal amount of magnesia, differ appreciably from other analyses of pectolite, and no simple formula is deducible from them. The material is no doubt impure, since it is not always completely decomposed by hydrochloric acid. The mineral is largely altered, apparently to prehnite. L. J. S.

Composition of Nepheline. Józef A. Morozewicz (*Bull. Acad. Sci. Cracow*, 1907, 958—1008).—Nepheline is completely soluble in a *N*/4 solution of hydrochloric acid, and this gives a method of readily separating enclosed impurities (felspars, mica, hæmatite, &c.), which in earlier analyses must have been weighed with the silica. In the following new analyses, each the mean of two determinations, special precautions were observed; the alkalis, for example, were not determined at the end of the analysis, since their amount would be increased by the accumulation of impurities from the reagents. I, is of grey, porphyritic crystals from mariupolite (Abstr., 1902, ii, 668);

D 2·631 (not allowing for 12% of enclosed albite). II, a large mass of elæolite also from mariupolite, with 9·8% insoluble material (albite, ægirite, beckelite, &c.). III, grains of red elæolite from mariupolite, enclosing 50% of perthite and hæmatite. IV, elæolite from Mias, Urals; D 2·645; the powdered mineral gives an alkaline reaction in water, and, after digestion for twelve hours, 0·45% is dissolved. V, well-formed crystals of nepheline from Vesuvius; D 2·64. VI, small, prismatic crystals from Vesuvius, with 0·5% insoluble enclosures:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	43·65	0·10	33·12	0·48	0·49	—	5·69	15·91	0·74	100·18
II.	43·46	0·07	32·82	0·75	0·31	—	5·55	16·12	0·89	99·97
III.	43·55	0·03	32·96	0·66	0·25	—	6·09	16·00	0·33	99·86
IV.	42·71	0·04	33·83	0·40	0·32	trace	5·86	16·46	0·18	99·86
V.	42·53	0·01	33·92	0·30	1·97	0·07	5·82	15·12	0·13	100·11
VI.	43·34	trace	33·75	0·50	2·20	0·24	4·34	15·66	0·23	100·26

In all these analyses, the molecular ratio of $(Al,Fe)_2O_3 : (Na_2,K_2,Ca)O = 1 : 1$; but the ratio of $(Si,Ti)O_2 : (Al,Fe)_2O_3$ varies from 2·11 : 1 to 2·21 : 1 (being 2·21 : 1 in analyses I—III). The ratio of $K_2O : (Na_2O + CaO)$ varies from 1 : 4·06 to 1 : 5·6, being usually 1 : 4·4. These and previous analyses are discussed in detail, and evidence is adduced to show that potassium (which is invariably present in nepheline) and sodium do not replace each other isomorphously. Most analyses may be referred to the following series of normal nephelines:

$$K_2Na_8Al_{10}Si_{11}O_{42} = K_2Al_2Si_3O_{10} + 4\ Na_2Al_2Si_2O_8$$
$$K_2Na_9Al_{11}Si_{12}O_{46} = K_2Al_2Si_3O_{10} + 4\tfrac{1}{2}Na_2Al_2Si_2O_8$$
$$K_2Na_{10}Al_{12}Si_{13}O_{50} = K_2Al_2Si_3O_{10} + 5\ Na_2Al_2Si_2O_8$$
$$K_2Na_{11}Al_{13}Si_{14}O_{54} = K_2Al_2Si_3O_{10} + 5\tfrac{1}{2}Na_2Al_2Si_2O_8$$

These formulæ represent double compounds of a potassium alumino-trisilicate (comparable with the silicate portion of sodalite, &c.) with a sodium alumino-disilicate (analogous to natrolite minus water). A few analyses (amongst them IV and V now given) represent a slightly more basic type with the formula

$$K_4Na_{18}Al_{22}Si_{23}O_{90} = 2K_2Al_2Si_{2\frac{1}{2}}O_9 + 9Na_2Al_2Si_2O_8.$$

L. J. S.

Mineralogy of Iron Mine Hill, Rhode Island. B. L. Johnson and Charles Hyde Warren (*Amer. J. Sci.*, 1908, [iv], **25**, 1—38).—In an account of the geology and petrography of Iron Mine Hill, near Cumberland in Rhode Island, a detailed description is given of the ultra-basic igneous rock called cumberlandite, which consists of olivine (46%), labradorite (9%), magnetite (20½%), and ilmenite (18%), with some spinel (3½%) and metallic sulphides (1%). Analysis I of the olivine shows it to be the iron-rich variety hyalosiderite. Analysis II is of the fresh, unaltered cumberlandite. Chloritic (anal. III), actinolitic, and serpentine (anal. IV) types of alteration of the cumberlandite are distinguished. The altered rock is traversed by narrow veins of secondary minerals, which are mainly actinolite (anal. V), clinochlore, and hortonolite (VI):

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
I.	37·16	0·07	—	0·12	31·38	0·40	31·16	trace	—	—	—	100·63*	3·728
II.	22·35	10·00	5·26	14·05	28·84	0·43	16·10	1·17	0·10	0·44	0·42	99·26†	3·92—4·0
III.	20·89	9·57	6·93	17·81	26·04	—	15·65	0·96	nil	trace	2·71	100·54	3·80—3·85
IV.	19·98	9·76	6·75	19·25	21·42	0·40	16·83	n. d.	trace	trace	4·77	99·32	3·56—3·65
V.	56·00	trace	1·00	0·10	7·14	0·10	20·52	14·03	trace	0·50	0·80	100·19‡	3·062
VI.	33·27	trace	—	0·37	49·32	1·50	16·08	—	—	—	n. d.	100·54	4·054

* Also, insoluble felspar 0·34%.

† Also (not included in total), V_2O_3, 0·18; Cr_2O_3, trace; CO_2, 0·02; P_2O_5, 0·02; S, 0·38; Zn, 0·71; Cu, 0·08; Co+Ni, 0·08; Pb, trace.

‡ Also, trace of fluorine (?).

This analysis of actinolite gives ratios agreeing closely with those of Penfield (Abstr., 1907, ii, 102). The hortonolite is a dark resinous mineral with distinct cleavages in two directions at right angles; in small fragments, it is pale yellow by transmitted light. The occurrence of this rare member of the olivine group as a secondary vein mineral is of interest. L. J. S.

The Volcano of Siroua, in the Morocco Atlas. Louis Gentil (*Compt. rend.*, 1908, **146**, 185—187).—A description is given of this extinct volcano, the rocks of which belong to two series, trachytic and phonolitic. Analyses are given of a biotite-trachyte and of a haüyne-ægirite-phonolite. L. J. S.

Origin of Laterite. Jean Chautard and Paul Lemoine (*Compt. rend.*, 1908, **146**, 239—242).—The products of decomposition of rocks are different in temperate and in tropical regions; in the former they consist of aluminium and iron hydroxides, and in the latter of aluminium silicates (clays). The products in tropical regions consist of bauxite and laterite, which are analogous in constitution, and are of importance as ores of aluminium and iron respectively. Twelve analyses by F. Pisani are given of rocks and their decomposition products from Guinea; the following are selected as examples. I and II are of fresh diabase, and I*a* and II*a* of the laterite which has been derived from the same rocks:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	P_2O_5.	Loss on ignition.	Total.
I.	51·80	1·56	13·83	—	9·80	11·21	7·85	0·68	2·27	0·06	0·50	99·56
I*a*.	12·60	3·24	34·71	22·78	1·26	0·63	0·16	0·32	0·14	—	23·70	99·54
II.	48·51	2·96	14·18	2·40	10·35	8·00	6·05	0·67	4·51	0·13	3·12	100·75
II*a*.	5·52	9·05	34·10	27·13	1·26	—	0·65	0·26	0·25	—	22·50	100·72

Assuming the titanium dioxide to be the most stable and constant constituent, it will be seen from these analyses that the decomposition has resulted in the removal of the calcium, magnesium, and alkalis, a removal of about four-fifths of the silica, and a slight removal of aluminium and iron; the percentage amounts of the latter being relatively increased. The aluminium is present as minutely crystallised hydrargillite ($Al_2O_3,3H_2O$), and the silica is free. The process of lateritisation therefore consists in the removal of certain constituents, and in the oxidation and hydration of others. L. J. S.

The Williamstown Meteorite. Edwin E. Howell (*Amer. J. Sci.*, 1908, [iv], **25**, 49—50).—This meteoric iron was found on 25th April, 1892, near Williamstown, Grant Co., Kentucky. It weighed about 31 kilos., with D 8·1. The structure is that of a typical octahedrite of medium coarseness. Bands of kamacite, tænite, and plessite are visible on the etched surfaces, with here and there nodules of troilite, some of which enclose carbonaceous matter and are surrounded by a skin of schreibersite. Analysis by W. Tassin gave:

Fe.	Ni.	Co.	Cu.	Cr.	P.	S.	C.	Si.	Total.
91·54	7·26	0·52	0·03	0·05	0·12	0·17	0·004	trace	99·694

L. J. S.

The Ainsworth Meteorite. Edwin E. Howell (*Amer. J. Sci.*, 1908, [iv], **25**, 105—107).—This meteoric iron, which weighed 10·65 kilos., was found in the winter of 1906–7 near Ainsworth, in Brown Co., Nebraska. The structure is octahedral, with very wide bands on the surface of which a minute, octahedral structure is also evident. Troilite and schreibersite are present. Analysis by W. Tassin gave:

Fe.	Ni.	Co.	Cu.	P.	S.	Cr.	Si.	C.	Sp. gr.
92·22	6·49	0·42	0·01	0·28	0·07	0·01	0·05	0·09	7·85

L. J. S.

Physiological Chemistry.

Cheyne-Stokes Respiration. Marcus S. Pembrey (*J. Pathol. Bacteriol.*, 1908, **12**, 258—265).—This type of breathing is not necessarily pathological, but is a sign of decreased excitability of the nervous system. Carbon dioxide increases, and oxygen diminishes, until the depressed cells of the respiratory centre are stimulated to produce shallow and inefficient respiratory efforts, so that the increase of carbon dioxide and decrease of oxygen in the blood still continue; this in time increases the respiratory efforts, and culminates in dyspnœic breathing, which sweeps out the carbon dioxide and increases the oxygen taken in; the stimulation of the centre wanes, and finally apnœa sets in until the same series of events is repeated. This view is supported by analyses, and numerous tracings of the respiratory movements are given. W. D. H.

Equilibrium between the Cell and its Environment, with Special Reference to Red Blood Corpuscles. Benjamin Moore and Herbert E. Roaf (*Bio-Chem. J.*, 1908, **3**, 55—81).—The membrane theory fails to explain many phenomena, such as the difference in composition of the electrolytes within and without the cell, and the variations they undergo in different media. The view is advanced that adsorpates, or chemical combinations, are formed within the cell between the electrolytes and the proteins. These constituents undergo reversible changes of association and dissociation with alterations of osmotic pressure; the range varies for each constituent, and within it labile changes are alone possible. Drugs, toxins, and other agencies produce other adsorpates or compounds which upset cell-metabolism, on account of their stability at given osmotic pressures.

W. D. H.

Proteic Acids in Blood. J. Browiński (*Zeitsch. physiol. Chem.*, 1908, **54**, 548—549).—The proteic acids of Bondzyński and others, which are discoverable in human urine, occur also in the urine of the horse. They can also be detected in the blood-serum of the horse after proteins have been removed by acidification, boiling, and filtering. They are not identical with urochrome. W. D. H.

Researches in Phagocytosis. Hartog J. Hamburger and E. Hekma (*Proc. k. Akad. Wetensch. Amsterdam*, 1907, **10**, 144—166).—The activity of the cells was determined by counting the percentage which took up carbon particles. The addition of water lessens this activity, but replacement of the cells in their own serum restores it either wholly or partly. A heightening of the concentration of the serum by salt similarly damages the cells, and again restoration occurs when they are returned to their own serum. In solutions of 0·9% sodium chloride, the phagocytic power is about equal to that in serum. In some cases, chemical action rather than osmotic changes alters phagocytic power; thus Ca ions and also OH ions increase it. Na ions are not harmful to leucocytes, although Loeb found they were to larvæ, heart muscle, &c. W. D. H.

Variations in the Proteolytic Activity of Pancreatic Juice. Lucien Camus and Eugène Gley (*J. Physiol. et Pathol. gén.*, 1907, 987—998).—The juice secreted under the influence of secretin is not always without action on proteins. When the secretion ceases after the first injection, the first portion of that secreted as a result of a second injection is slightly active, digesting egg-white more or less completely in thirty-six to forty-eight hours. If the second injection is made before the effect of the first has passed off, the juice is inactive. The juice which is secreted under the influence of an injection of Witte's peptone, or pilocarpine, is always slightly active, the secretion of active juice alternating with periods of the secretion of inactive juice. The addition of potassium oxalate to the juice, sufficient in amount to precipitate all its calcium salts, hinders, but does not abolish, its proteolytic activity. W. D. H.

Calcium Metabolism. S. W. Patterson (*Bio-Chem. J.*, 1908, **3**, 39—54).—A diet of oatmeal and maize produces calcium starvation in rabbits, but the blood undergoes no loss of calcium. The bones, however, lose calcium. In experiments on rabbits and men, the conclusion is drawn that the bones are the seat of calcium storage.
W. D. H.

Fate of Carbon Acids in the Dog. I. Normal *dl*-*a*-Amino-acids. II. Methylated *dl*-*a*-Amino(Normal)-acids. III. Methylated *dl*-*a*-Amino-acids containing Side-Chains. IV. Dimethylated *dl*-*a*-Amino(Normal)-acids. V. Synthesis of Acetoacetic Acid by Perfusion through the Liver. Ernst Friedmann (*Beitr. chem. Physiol. Path.*, 1908, **11**, 151—157, 158—176, 177—193, 194—201, 202—213).—Dogs were fed by the mouth on the various acids, and the urine examined for the substances given; the

C : N ratio was also taken as a guide as to whether the materials administered had passed into the urine. I. Glycine, *dl*-alanine, *dl*-amino-*n*-butyric acid, *dl*-amino-*n*-valeric acid, and *dl*-amino-*n*-hexoic acid were given. Thirteen % of the last-named substance passed into the urine; the remaining acids were almost completely broken down in the body.

II. In the second series, sarcosine, *dl*-α-methylamino-propionic, -butyric, -valeric, and -hexoic acids were given. The first two were found in the urine to about one-third of the amount given. The last three left the body almost unchanged.

III. In the third series, *dl*-α-amino*iso*butyric acid, *dl*-α-methylamino-*iso*valeric acid, *dl*-α-methylamino-β-methylvaleric acid, and *dl*-α-methylamino-γ-methylvaleric acid were given. The presence of a second tertiary hydrogen atom increases the ability of the organism to decompose the acid given; this is still more the case when the tertiary hydrogen atom is in the β-position to the carboxyl group.

IV. Dimethylaminoacetic, *dl*-α-dimethylamino-*n*-propionic, *dl*-α-dimethylamino-*n*-butyric, *dl*-α-dimethylamino-*n*-valeric and *dl*-α-dimethylamino-*n*-hexoic acids were given. On the average, about 50% of the substance administered was excreted as such. The introduction of the second methyl group does not therefore increase the difficulty of the organism to deal with the acids.

V. This research is on rather different lines to the four which precede it. The liver was perfused with a mixture of Ringer's fluid and blood to which various substances were added (alcohols, aldehydes, organic acid, &c.); many of these lead to the appearance of acetone in the issuing fluid. Of those investigated, only acetaldehyde and aldol led also to the appearance of acetoacetic acid. In the case of the first of these, aldol is probably first formed as a condensation product.

W. D. H.

Production of Fat from Proteins. Estimation of Fat. Elly A. Bogdanoff (*J. Landw.*, 1908, **56**, 53—87).—The results of experiments with pigs indicated that mixed foods very rich in proteins had very slight fattening effect. It is, however, considered probable that a certain amount of fat can be formed from protein.

In estimating the amounts of fat, the substance, cut thin and dried at 97—100°, is first kept in contact with ether for some hours. It is then cut into smaller pieces, and again extracted. The residue is then finely ground, extracted with ether for two days in a Soxhlet apparatus, after which it is treated with boiling alcohol for two days or longer. The residue obtained by distilling the alcoholic extract is extracted with ether, and all the ether extracts united. The substance is practically free from fat after the above treatment. Traces of fat can, however, be obtained by Dormeyer's artificial digestion method, followed by extraction with ether.

N. H. J. M.

Parenteral Nitrogenous Metabolism. I. Leonor Michaelis and Peter Rona (*Pflüger's Archiv*, 1908, **121**, 163—168).—In a dog in nitrogenous equilibrium, half of the milk in the diet used during the first period of the research was withdrawn, and a subcutaneous injection of the corresponding quantity of caseinogen substituted. There was a great increase in nitrogenous excretion, although no caseinogen as such passed into the urine. The injected protein is believed to have been katabolised, and at the same time some of the nitrogenous breakdown is attributed to a toxic action; the animal gave indications of this by a rise of temperature and other symptoms. The most noteworthy effect, which was subsequently confirmed on other animals, was a swelling of the mammary glands, leading in some cases to actual milk formation. This suggests that the mammæ do not actually form caseinogen, but are merely the seat of its excretion. W. D. H.

Protein Synthesis in Animals. VALDEMAR HENRIQUES (*Zeitsch. physiol. Chem.*, 1908, **54**, 406—422).—If animals are fed with the abiuretic products of protein cleavage obtained by the action of trypsin and erepsin, they remain in nitrogenous equilibrium, or may even put on nitrogen. If these products are boiled for six hours with 20% sulphuric acid, they retain this property; but after seventeen hours' boiling they lose it. What this means exactly, it is impossible to say. It was, however, noticed that the tryptophan reaction remained unchanged in the products capable of utilisation. W. D. H.

The Value of Amides in Carnivora. W. VÖLTZ and G. YAKUWA (*Pflüger's Archiv*, 1908, **121**, 117—149. Compare Abstr., 1907, ii, 109).—A mixture of ammonium acetate, acetamide, and glycine increases the absorption of nitrogenous material; asparagine does not influence nitrogenous katabolism until after its administration ceases, and then it is lessened; acetamide increases nitrogenous katabolism, and ammonium acetate has a still more marked effect; glycine has no effect. W. D. H.

Chemical Studies on Growth. IV. Transformation of Glycogen by Enzyme Action in Embryonic Tissues. LAFAYETTE B. MENDEL and TADASU SAIKI. **V. Autolysis of Embryonic Tissues. VI. Purines, Pentose, and Cholesterol of Eggs. VII. Catalase in Embryonic Tissues. VIII. Lipase in Embryonic Tissues. IX. Embryonic Muscular and Nervous Tissues.** LAFAYETTE B. MENDEL and CHARLES S. LEAVENWORTH (*Amer. J. Physiol.*, 1908, **21**, 64—68, 69—76, 77—84, 85—94, 95—98, 99—104. Compare Abstr., 1907, ii, 895).—Embryo pigs were used throughout.

IV. The embryonic muscle contains glycogen at an earlier date than the liver, and when digested with glycogen causes more of it to disappear than in the case of the liver. In later embryonic life, the liver acquires its characteristic capacities, and overtakes the muscles in efficiency. These organs were not freed from blood, but in all cases the glycogen digesting power of the blood is relatively small.

V. Experiments on autolysis were confined to the liver; autolysis in the fœtal liver is less rapid than that in the adult; this is not due to lack of autolytic ferments, but to the want of development of acid, which in its turn may be attributable to scarcity of carbohydrate. If the acidity is artificially equalised in the two cases, autolysis proceeds at an equal velocity in both.

VI. The figures given adduce further evidence of the progressive synthesis of purines during embryonic growth, and, as in adult and embryo organs already examined, guanine and adenine predominate. The yield of pentose (absent in fresh eggs) increases as nucleo-proteins are elaborated. There is no evidence that a synthesis of cholesterol occurs in the development of the chick; that present in early stages appears like other lipoids of the yolk to disappear, acting as sources of energy in growth.

VII. Any difference in the amount of oxygen liberated from hydrogen peroxide by embryonic, as compared with adult, organs appears to be due to extraneous causes (for example, the inhibiting influence of acid) rather than to an absence of catalase in the embryonic tissues.

VIII. Lipase is present at an early stage in the embryonic liver and intestine; but the action of extracts is less pronounced than that of those obtained from full-grown animals.

IX. Embryonic tissues are relatively rich in water. Creatine is present in the embryonic muscle, but in less amount than in the adult. Among the purine bases, adenine and guanine preponderate as in other tissues. Hypoxanthine is free in the tissue as in the adult.

W. D. H.

Importance of Calcium Salts for the Growing Organism. HANS ARON and ROBERT SEBAUER (*Biochem. Zeitsch.*, 1908, **8**, 1—28).—The amount of lime required by a growing mammal is at least 1·2% of the increase in body weight. The same diet may at one time contain enough lime, when given in small quantity, so as to produce but little growth, and at another time, when given in large rations, it may not contain enough lime, on account of the more rapid increase in body weight. The body as a whole is not affected by a shortage of lime; the effects are limited to the skeleton (possibly the brain is also affected to some extent). The bones do not weigh less, but contain less organic substance and more water than normal ones. The dry substance of the skeleton of lime-starved animals also contains a smaller percentage of ash than that of normal animals, but the proportion of calcium in the ash is not appreciably decreased. These chemical changes agree with those observed in rachitic bones.

G. B.

Nitrates in Vegetable Foods, Cured Meats, and Elsewhere. WILLIAM D. RICHARDSON (*J. Amer. Chem. Soc.*, 1907, **29**, 1757—1767).—The results of a large number of determinations of nitrates in different foods (fruits, vegetables, and cured meats), showed that with a diet consisting of fresh vegetables, the equivalent of 1 to 2 grams of sodium nitrate could be consumed daily. Smaller amounts of nitrates could be consumed with a diet consisting partly of cured meats, so that the quantities of nitrates in the latter must be considered harmless.

N. H. J. M.

The Substitution of Bromine by Chlorine in the Animal Body. M. BÖNINGER (*Chem. Zentr.*, 1907, ii, 1539; from *Zeitsch. exper. Path. Ther.*, 1907, **4**, 414—418).—In absolute chlorine hunger in the dog, bromine can take its place; even in the blood serum, chlorides are replaced by bromides. Cumulation of the halogen was not observed. W. D. H.

The Cell and its Medium. III. Inorganic Salts of the Protozoan Cell and its Medium. AMOS W. PETERS (*Amer. J. Physiol.*, 1908, **21**, 105—125).—*Paramœcia* were placed in pure distilled water which was frequently changed, the organisms being at each change separated by the centrifuge. Mere centrifugalising was found to produce no injury. In spite of this, the animals contaminated the water; this was due to the diffusion outwards of the salts of the cells, and this led to loss of movement and, finally, death. Moderate withdrawal of the salts is harmless. W. D. H.

[Amount of] Arginine, Lysine, and Histidine in the Hydrolytic Products of Various Animal Tissues. ALFRED J. WAKEMAN (*J. Biol. Chem.*, 1908, **4**, 119—147).—Variations occur in the yield of these three substances from different tissue proteins. The group (or groups) in the protein molecule which yield the bases is large in the case of muscle, and small in that of the kidney; but in the same organ of different species of animal, the variations are very small. In pathological organs, even when gross changes occur, as in acute atrophy of the liver, the composition of the liver protein is not essentially changed so far as the amount of, and proportion between, the bases is concerned, and the amount of histidine is least influenced by degenerative changes. W. D. H.

The Work of the Intestinal Muscle. OTTO COHNHEIM (*Zeitsch. physiol. Chem.*, 1908, **54**, 461—480).—The production of carbon dioxide in the normal movements of the intestine is from 20 to 36 mg. per 100 grams of muscle per hour. This is about one-tenth of that found in striped muscle, and from 1/20 to 1/70 of that produced by glandular activity. The movements were made to occur by placing the intestine in oxygenated Ringer's solution. W. D. H.

Formation of Dextrorotatory Lactic Acid in Autolysis. III. In Muscle. KATSUJI INOUYE and K. KONDO (*Zeitsch. physiol. Chem.*, 1908, **54**, 481—500).—During autolysis of rabbit's and bird's muscle, there is, as in rigor mortis, a formation of sarco-lactic acid, even in the presence of chloroform water. Later (about the seventh day of autolysis), the amount diminishes. In the muscles of cold-blooded animals (fish), the same occurs, but the increase is not so marked. The same occurs in filtered extracts of the muscles, and therefore the acid cannot be a product of cellular activity. The action is regarded as due to a ferment, and the source of the acid to be both carbohydrate and protein. W. D. H.

Vagus Inhibition and the Output of Potassium from the Heart. WILLIAM H. HOWELL and W. W. DUKE (*Amer. J. Physiol.*, 1908, **21**, 51—63. Compare Abstr., 1907, ii, 110).—If the isolated mammalian heart is perfused with Locke's fluid and the vagus stimulated, the increase in potassium of the fluid may amount to as much as 29%. It is believed that the inhibiting influence of the vagus is due to the liberation of potassium in diffusible form, and it is the potassium which inhibits the heart. The amount of calcium in the circulating fluid does not alter. Stimulation of the accelerator nerves causes no increase in the amount of potassium in the circulating fluid. W. D. H.

Carbon Dioxide in the Regulation of the Heart Rate. YANDELL HENDERSON (*Amer. J. Physiol.*, 1908, **21**, 126—156).—In dogs under artificial respiration, the development of shock is dependent, not upon the extent of injury, or the intensity of stimulation of afferent nerves, but on the rate of pulmonary ventilation. Diminution in the amount of carbon dioxide in arterial blood increases the heart rate up to cardiac tetanus, and by regulation of the rate of pulmonary ventilation the heart can be adjusted to any desired rate of beat. The hypothesis is presented that acapnia (this is, diminution of carbon dioxide in the blood and tissues resulting from hyperpnœa and from exhalation of carbon dioxide from exposed viscera) is the cause of surgical shock. W. D. H.

The Iron of the Liver. V. SCAFFIDI (*Zeitsch. physiol. Chem.*, 1908, **54**, 448—460).—One hundred grams of rabbit's liver contains 9 mg. of iron; there are on the average 19 mg. of iron para-nucleinates in the whole liver. The nucleo-protein contains from 0·18% to 0·44% of iron. In animals treated with iron para-nucleinate, this rises to 1·1%. The quantity of iron in the nucleo-protein is, however, not proportional to the total iron of the liver. Although the amount of iron in the nucleo-protein is thus variable, the percentage of phosphorus is constant. W. D. H.

Nature of the Fat in Normal and Pathological Human Livers. PERCIVAL HARTLEY and A. MAVROGORDATO (*J. Path. Bact.*, 1908, **12**, 371—377).—The iodine value of the higher fatty acids from adipose tissue is 65; that from the normal liver 115—120. When the amount of fat in the liver is abnormally great, the iodine value falls. Whether this is due to fat transported from the adipose tissue or to excessive formation of fat from carbohydrate is discussed, but left uncertain. W. D. H.

Perfusion of Excised Kidneys. IX. Effects of Poisons. TORALD SOLLMANN and ROBERT A. HATCHER (*Amer. J. Physiol.*, 1908, **21**, 37—50).—The ureter-flow in excised kidneys depends mainly on glomerular pressure, and the various poisons investigated are regarded as having their effect rather on the vessels than on the renal epithelium. Chloral, *Hydrastis*, hydrocyanic acid, and juniper cause vaso-dilation and increase of ureter flow; adrenaline, sodium arsenate, digitalis, mercuric chloride, and picric acid have the reverse effect. Alcohol, caffeine, cantharidin, carbon dioxide, carbon monoxide, ergot, formaldehyde, hydrastinine, and sodium thiocyanate in the concentrations used have no effect. The effect of the drugs on the intact kidney *in vivo* in cases where the comparison is capable of being made, is stated to be the same as in the excised organ. W. D. H.

The Occurrence of Scatole in the Human Intestine. Christian A. Herter (*J. Biol. Chem.*, 1908, **4**, 101—109).—Scatole is by no means always present in the lower gut in either children or adults. When intestinal putrefaction is excessive, it is present, and this is sometimes accompanied with increased formation of indole. When indole is absent in the fæces, indican is present in the urine; hence the scatole is probably produced later in the intestine. Its formation is due mainly to putrefactive anaërobic bacteria. Certain strains of the bacillus of malignant œdema and of *B. putrificus* form scatole; but *B. coli communis* forms indole, and usually little or no scatole. The conditions giving rise to the two products are thus different. The formation of indoleacetic acid is perhaps a necessary step in the production of scatole, most bacteria attacking it with difficulty if at all. W. D. H.

Constituents of Ox Bile. I. Kurt Langheld (*Ber.*, 1908, **41**, 378—385).—A new method is described for treating the acids of ox bile, which allows of the isolation of more than 80% of the crude product in the form of definite chemical compounds. The crude acids are treated directly with alcohol, which leaves the cholic acid undissolved, and after separation of the fatty acids the remainder is esterified by Fischer's method. The substances isolated are obtained in the following percentages: cholic acid, 50·8; palmitic and stearic acids, 5·4; deoxycholic acid, from the esters soluble in light petroleum, 1; deoxycholic acid, from the insoluble esters, 20·7. The last is a mixture of deoxycholic acid, m. p. 172—173°, $[\alpha]_D^{20}+53\cdot28°$, and its isomeride, Mylius's choleic acid, m. p. 187—188°, $[\alpha]_D^{20}+47\cdot97°$, the existence of which, although denied by Latschinoff (Abstr., 1887, 682) and Lassar-Cohn (Abstr., 1893, ii, 220), is now confirmed. Myristic acid was not found in the bile. G. Y.

The Protein Hydrolysis of Cows' Milk. Albert J. J. Vandevelde (*Bull. Soc. chim. Belg.*, 1907, **21**, 434—458).—The author finds that a 3% solution of iodoform in acetone is the most suitable reagent for use in studying the enzymes of milk. The addition of 3·3 c.c. of this solution to 25 c.c. of milk sterilises the latter completely without interfering with the action of the enzyme. It is shown that the proteolytic enzyme present in cows' milk is capable of digesting about two-thirds of the proteins present in the milk; the action is limited, and does not appear to be influenced by the age of the cow or by the quantity of milk yielded by the cow. The activity of the enzyme bears no relation to the period of lactation. W. P. S.

Parent Substance of the Hippuric Acid Produced in Animals. Haralamb Vasiliu (*Bied. Zentr.*, 1908, **37**, 29—32; from *Mitt. Landw. Inst. Univ. Breslau*, 1906).—The chief source of hippuric acid seems to be phenylalanine. The fact that carnivorous animals, notwithstanding the considerable amounts of phenylalanine present in meat, eliminate only small amounts of hippuric acid in the urine is shown, by an experiment made by the author on himself, to be probably due to the combustion of the benzene ring.

N. H. J. M.

The Relation of Nitrifying Bacteria to the Urorosein Reaction of Nencki and Sieber. CHRISTIAN A. HERTER (*J. Biol. Chem.*, 1908, **4**, 239—251).—The urorosein reaction sometimes (perhaps always) depends for its development, when the reaction is induced by adding hydrochloric acid to the urine, on the presence of bacteria in that fluid. The bacteria can be isolated, and a pure culture obtained; if this is added to sterile urine, the typical urorosein reaction can then be obtained. These bacteria are capable of forming nitrites, and the reaction depends on the liberation of nitrous acid.

Doubtless the urorosein chromogen would be more frequently detected if nitrites were employed; the action is probably due to oxidation, and not to the formation of a nitroso-compound. Urorosein is distinct from scatole-red, and its chromogen occurs quite independently of the absorption of scatole from the intestine. The urorosein chromogen is indoleacetic acid, but further evidence of this is postponed. W. D. H.

A Thermosoluble Protein said to be that of Bence-Jones. L. GRIMBERT (*J. Pharm. Chim.*, 1908, [vi], **27**, 97—101).—The proteins from urine, described by various authors as the albumose of Bence-Jones, are not identical, and chiefly resemble each other in being redissolved on heating. The solubilities of the protein in a case observed by the author are compared with those observed by other French investigators (compare Patein, Abstr., 1904, i, 954). G. B.

Excretion of Urochrome in Man. ST. DOMBROWSKI (*Zeitsch. physiol. Chem.*, 1908, **54**, 390—397).—Urochrome is precipitated as a compound with cuprous oxide. The nitrogen in this was determined, and from this was subtracted the nitrogen due to the presence of purine substances in the precipitate. Normal urine contains from 0·45 to 0·47 gram in the twenty-four hours. In pneumonia (1 case), the amount was 0·78; in typhoid fever (4 cases), it rose to 0·76—1·05.

W. D. H.

Changes in the Bile Occurring in some Infectious Diseases. HELEN BALDWIN (*J. Biol. Chem.*, 1908, **4**, 213—220).—Although the method used (Ritter's) for the estimation of the cholesterol is not considered absolutely accurate, the following facts were noted: the increase in the cholesterol of the bile is slight in cholecystitis if there is free drainage, and but little disintegration of epithelium cells is present. The increase is marked when the bile flow is obstructed, and the bile filled with masses of degenerating cells. Most of the increase is in suspension rather than solution. Cholecystitis is a common complication not only in typhoid fever as is well known, but also in pneumonia and suppuration in various parts. W. D. H.

Prosecretin in Relation to Diabetes Mellitus. Francis A. Bainbridge (*Bio-Chem. J.*, 1908, **3**, 82—86).—The yield of secretin from the duodenal mucous membrane is almost or quite as great in diabetic as in non-diabetic people. It is doubtful if the absence of prosecretin has any causal relationship to diabetes. In the cases where observers have failed to find it, it is suggested that its disappearance is due to rapid post-mortem changes. W. D. H.

Production of Glycosuria in Rabbits by Intravenous Injection of Sea-water made Isotonic with the Blood. Theo. C. Burnett (*J. Biol. Chem.*, 1908, **4**, 57—62).—The magnesium in sea-water is responsible for the glycosuria that follows its injection. W. D. H.

Metabolism, Nitrogenous and Inorganic, in Pancreatic Diabetes in Dogs. W. Falton and James Lyman Whitney (*Beitr. chem. Physiol. Path.*, 1908, **11**, 224—228).—After extirpation of the pancreas there is an enormous increase in protein katabolism, which cannot be ascribed to fever (as it partly may in phloridzin diabetes), nor to accidental occurrence of infectious disease. This is accompanied by a relatively large increase in the mineral constituents of the urine, and also a rise in endogenous uric acid formation. The tissue breakdown appears to be particularly great, for the tissue proteins are richer in saline material than reserve proteins. It is possible that bone atrophy may contribute to the result. W. D. H.

Lactic Acid in Eclampsia. Julius Donath (*Zeitsch. physiol. Chem.*, 1908, **54**, 550).—It is pointed out that A. ten Doesschate's view (this vol., ii, 122) that lactic acid is the result and not the cause of convulsions has been advanced previously by the author. W. D. H.

The Purgative Inefficiency of Saline Cathartics when Injected Subcutaneously or Intravenously. John Auer (*J. Biol. Chem.*, 1908, **4**, 197—212).—MacCallum (Abstr., 1903, ii, 742; 1904, ii, 63, 191, 755) stated that saline purgatives have the same action whether they are introduced into the alimentary canal, or injected subcutaneously or intravenously. This was disputed by the present author (Abstr., 1906, ii, 876), but confirmed by Bancroft. The present paper is a reply to the latter, and reaffirms the author's previous contentions. W. D. H.

The Behaviour of Calcium Formate and Acetate in the Organism. Attilio Bonanni (*Chem. Zentr.*, 1907, ii, 1803; from *Arch. Farm. sper.*, 1907, **6**, 419—443).—The urine of dogs and rabbits contains normally minute quantities of formic and acetic acids. After intravenous or subcutaneous administration of the calcium salts of these acids, the amount increases, but the quantity excreted is not so great as that given. The actual quantities vary in the two animals. Numerical details are given. W. D. H.

Behaviour of Quinine in the Body. Paul Grosser (*Biochem. Zeitsch.*, 1908, **8**, 98—117).—Great discrepancies as to what happens to quinine in the body occur in previous writings on the subject.

Phosphotungstic acid precipitates it quantitatively in the urine, and in albuminous solutions, such as extracts of organs, the loss is almost 2% if protein material is removed by the kaolin method of Rona and Michaelis. The present observations were made on people suffering from malaria. The fæces contain at most 1% of the amount of quinine administered. If given by the mouth, or injected into the muscles, a quantity varying from 8% to 46% is recoverable in the urine. The causes of this extreme variation is far from clear. The remainder does not accumulate in the tissues, but is destroyed there. Perfusion of the liver by Brodie's method with Ringer's solution containing quinine shows that the issuing fluid contains less than that which enters, and the liver has the power of decomposing quinine. W. D. H.

Is Arsenious Anhydride, Introduced into the Animal Organism, Eliminated Unchanged or as Arsenic Acid? MARIO TONEGUTTI (*Boll. chim. farm.*, 1907, **46**, 899—908. Compare Abstr., 1907, ii, 908).—Arsenious acid, when introduced into the organism either by ingestion or intravenously, reappears unchanged in the urine, and is transformed into arsenic acid when the urine is treated with magnesia mixture. T. H. P.

The Influence of Potassium Cyanide on Protein Metabolism. ALFRED N. RICHARDS and GEORGE B. WALLACE (*J. Biol. Chem.*, 1908, **4**, 179—196).—There is an increase in the excretion of total nitrogen, which is due partly to the increased muscular work associated with the convulsions, and partly to the dyspnœa, but mainly to a specific influence of the poison on cell metabolism. The urea excretion runs parallel with that of total nitrogen, in spite of interference with respiration. This affords evidence that urea formation is not oxidative. The ammonia output varies within normal limits. There is a distinct increase in preformed creatinine; creatine was also found in the urine. The undetermined nitrogen varies considerably, but there is no evidence that any significant excretion of amino-acids occurs. Small doses of cyanide cause a greater increase in oxidised sulphur excretion than large doses, and probably in the latter case the increase in "neutral sulphur" occurs at the expense of sulphur which would otherwise be oxidised. W. D. H.

The Influence of Hydrazine on the Intermediary Metabolism of the Dog. FRANK P. UNDERHILL and ISRAEL S. KLEINER (*J. Biol. Chem.*, 1908, **4**, 165—178).—In inanition, the dog excretes urine, in which the ammonia-nitrogen is slightly increased in proportion to the urea-nitrogen. The excretion of creatinine varies, and there is a large output of creatine. Allantoin also is a constant constituent of such urine. In hydrazine poisoning, the partition of urinary nitrogen and sulphur is only slightly different from that which obtains during inanition. It has no specific action in causing an elimination of allantoin. It causes fatty degeneration of the liver. Emphasis is laid on the protective adaptation of the liver during hydrazine poisoning. W. D. H.

Comparison of the Hæmolytic and Toxic Action of Eel's Serum on the Marmot. LUCIEN CAMUS and EUGÈNE GLEY (*Arch. internat. Pharmacodyn. Thér.*, 1905, **15**, 159—169).—Eel's serum is globulicidal and also toxic towards the rabbit and guinea-pig. The pigeon, on the other hand, is very resistant to both actions. There are, however, animals, such as the marmot, in which the hæmolytic action is slight, and yet the serum is very toxic. Moreover, a temperature sufficiently high to destroy the hæmolytic power of eel's serum, only lessens its poisonous action. Not only are toxic actions elective, but the same is true for immunity. W. D. H.

Lecithid Formation. PRESTON KYES (*Biochem. Zeitsch.*, 1908, **8**, 42—46. Compare Abstr., 1907, ii, 569).—Polemical. A reply to Michaelis and Rona, (Abstr., 1907, i, 667); and Morgenroth and Carpi (Abstr., 1907, ii, 570).—The author adheres to the views he has expressed. G. B.

Chemistry of Vegetable Physiology and Agriculture.

Further Studies on Putrefaction. LEO F. RETTGER (*J. Biol. Chem.*, 1908, **4**, 45—56).—Real putrefaction is the work of anaërobes. *Bacillus tetani* has little or no putrefactive action on native proteins. *B. aërogenes capsulatus* attacks proteins slightly, but the change is not genuine putrefaction. *B. putrificus* and *B. maligni œdematis* are present in normal fæces in small amount, and probably in spore form only. As spores, they are able to resist the unfavourable conditions of the human intestine. W. D. H.

Fermentation of Formic Acid by Proteus vulgaris. HARTWIG FRANZEN and GEORG BRAUN (*Biochem. Zeitsch.*, 1908, **8**, 29—39).—The same amount of formic acid is fermented in a given time and at a given concentration, whether the acid is present as potassium or as sodium salt. The velocity of the reaction is increased by increasing the concentration of the formate. G. B.

Sugar Formation and other Fermentative Processes in Yeast. ERNST SALKOWSKI (*Zeitsch. physiol. Chem.*, 1908, **54**, 398—405. Compare Abstr., 1889, 1027).—On autolysis of yeast in chloroform water, a fermentable sugar is formed from the carbohydrate material of the cells. The fluid, however, is lævorotatory, but this action is not necessarily due to the fermentable sugar, for the fluid contains a mixture of numerous substances, such as gum, dextrin, pentoses, purine bases, tyrosine, lysine, leucine, peptone, and sometimes succinic acid. The sugar was identified as dextrose by separating it as a diphenylhydrazone compound. W. D. H.

Constitution of Aqueous Solutions, and the Influence of Salts on Alcoholic Fermentation. ALBERT J. J. VANDEVELDE (*Chem. Zentr.*, 1907, ii, 1435; from *Bull. Assoc. Anciens Élèves del' Inst. Brasserie, Gand*, **13**, 83—94).—The velocity of the fermentation of sugar in presence of various inorganic salts has been followed gravimetrically, and the results are expressed in tables in terms of the number of hours required for the decomposition of three-fourths of the sugar, termed the "fermentation energy." Within concentrations of 2—10%, barium chloride, ammonium sulphate, magnesium sulphate, and zinc sulphate appear to be without influence on the velocity of the fermentation, but the numerous other inorganic salts investigated retard the fermentation, in some cases to an extent approximately proportional to the increase in the osmotic pressure of the solution.

G. Y.

Influence of Micro-organisms on the Utilisation of the Insoluble Phosphates by Higher Plants. SANTE DE GRAZIA and A. CERZA (*Bied. Zentr.*, 1908, **37**, 85—86; from *Staz. sper. agrar. ital.*, 1906, **39**, 817).—Experiments with *Aspergillus niger*, *Penicillium glaucum*, and *P. brevicaule* showed that the moulds have a dissolving action on tricalcium phosphate.

N. H. J. M.

Chemistry of the Higher Fungi. I. Trametes suaveolens. JULIUS ZELLNER (*Monatsh.*, 1908, **29**, 45—54. Compare Abstr., 1904, ii, 679; 1905, ii, 550; 1906, ii, 572).—In continuation of his investigations into the chemistry of the fungi, the author has undertaken the study of some parasitic fungi, and now gives an account of the results obtained with *Trametes suaveolens*.

The fungus was gathered from willows in February and March, when full of sap, but still free from spores. The freshly-gathered fungus contains 65—67%, the air-dried material 7—9%, of water. When incinerated, the completely dried substance yields 2·9% of ash, consisting chiefly of potassium and calcium sulphates and carbonates, with smaller amounts of magnesium, phosphoric acid, and silica, and traces of sodium, iron, aluminium, and chlorine.

The light petroleum extract amounts only to 0·8%. The crude fat is yellow, deposits a crystalline *substance*, and gives the acid number 32·29—29·40, and the hydrolysis number 175·2—172·0; the small amount of fatty acid obtained has the acid number 186·1, and consists chiefly of oleic acid; the very small amount of solid fatty acids obtained has m. p. 74°. It is shown that the powdered fungus contains a lipolytic ferment. The soap from the crude fat, on extraction with ether, yields a substance, m. p. 158—167°, closely resembling the ergosterol obtained from fly agaric (Abstr., 1905, ii, 550); it is a mixture of two substances, of which the less soluble in alcohol,

$$C_{26}H_{44}O,H_2O,$$

has m. p. 165—167°.

The alcohol extract yields mycose and dextrose, but not mannose or trehalase (Bourquelot and Hérissey, Abstr., 1905, ii, 193). The resin from the alcoholic extract gives coloured precipitates with metallic acetates, and a brown coloration with ferric chloride.

The aqueous extract, 18—20%, contains dextrin or gum-like substances, pentosans in sufficient amount to give a strong furfuraldehyde reaction, a ferment which hydrolyses glucosides, a diastatic, and probably an inverting, ferment, and traces of proteins.

The fungus contains also amanitol, previously found in fly agaric, and, when distilled with very dilute sodium hydroxide, yields traces of ammonia and probably trimethylamine. The skeleton of the fungus does not give the lignin reactions. The grey colouring matter in old plants is insoluble. G. Y.

Supposed Extracellular Photosynthesis of Carbon Dioxide by Chlorophyll. ALFRED J. EWART (*Proc. Roy. Soc.*, 1908, **80**, *B*, 30—36).—A severe criticism of the work of Usher and Priestley (Abstr., 1906, ii, 299, 881). All forms of commercial gelatin turn pink in the presence of decolorised rosaniline; it is on this reaction that Usher and Priestley mainly depended for the detection of formaldehyde in their gelatin chlorophyll films. Moreover, chlorophyll itself, when exposed to light, yields formaldehyde as a decomposition product, whether in the presence or absence of carbon dioxide.

There is no conclusive evidence that living plant cells ever contain hydrogen peroxide, the other product of this supposed photosynthesis; it is probably always destroyed by catalase. The author has also failed to detect the evolution of oxygen from gelatin chlorophyll films and from dead cells of *Elodea* and *Vallisneria* as described by Usher and Priestley. The simultaneous production of formaldehyde and of hydrogen peroxide in a gelatin film appears to be improbable from the experiments of Geisow (Abstr., 1904, i, 289), who found that these substances interact with the formation of carbon dioxide, water, and hydrogen. G. B.

Hydrogen Cyanide and the Assimilation of Nitrogen in Green Plants. CIRO RAVENNA and ARRIGO PELI (*Gazzetta*, 1907, **37**, ii, 586—600).—The formation of hydrogen cyanide in *Sorghum vulgare* is traced to the indirect, simultaneous action of nitrates and carbohydrates, and, when these are removed, the proportion of the acid present diminishes rapidly. Light favours the formation of hydrogen cyanide, provided that the functions of the chlorophyll are not impaired. The acid seems to be the simplest substance which can be detected as taking part in the synthesis of proteins. T. H. P.

Production and Physiological Rôle of Pentosans in Plants. G. A. CALABRESI (*Bied. Zentr.*, 1908, **37**, 93—96; from *Staz. sper. agrar. ital.*, 1906, **39**, 69).—Determinations of pentosans were made in the different parts of maize, beet, and beans at different periods of growth. N. H. J. M.

Constant Composition of Vegetable Juices Obtained by Successive Extractions. GUSTAVE ANDRÉ (*Compt. rend.*, 1907, **145**, 1349—1352).—Experiments made with leaves of *Valerianella olitoria* and carrots (roots) showed that the composition of the extracts, as indicated by the ratios N : extract and ash : extract, remained almost the same whatever the pressure employed. N. H. J. M.

Nitrate-reducing Enzyme in Green Plants. ANNIE A. IRVING and RITA HANKINSON (*Bio-Chem. J.*, 1908, 3, 87—96).—The presence of a reducing enzyme in green plants is considered to be established. Asparagine is regarded as a stage in protein synthesis, but the centres for nitrate reduction and protein formation may be distinct. In ensilage the loss of nitrogen may be in part due to evolution of gaseous nitrogen, owing to the distribution of the enzyme becoming less localised. Normally, the only conditions necessary for nitrate reduction are the presence of the enzyme and a suitable carbohydrate. The latter condition suggests the leaf as the centre for reduction, and this agrees with the distribution of nitrates in the plant. Any hexose or polysaccharide is suitable for the supply of energy for nitrate reduction, not as in later stages of protein synthesis, where dextrose is the only carbohydrate which, together with asparagine, can provide the necessary basis for protein construction. W. D. H.

[Composition of] the Pulp of Parkia Biglobosa: "Farine de Netté." A. GORIS and L. CRÉTÉ (*Compt. rend.*, 1908, **146**, 187—189). —The substance is produced in the fruits of *Parkia*, and at the period of maturity is dry and friable. The percentage composition was found to be as follows: water, 4·90; N, 0·624; ash, 4·96; P_2O_5, 0·383; soluble in water, alcohol, and carbon disulphide, 72·00, 56·67, and 1·30, respectively. The pulp contains more sugar than any other known substance, the amount being sucrose, 25%, dextrose and lævulose, 20·5%.

N. H. J. M.

Vegetable Phosphatides II. ERNST WINTERSTEIN and O. HIESSTAND (*Zeitsch. physiol. Chem.*, 1908, **54**, 288—330. Compare Abstr., 1906, i, 478).—The phosphorus compounds soluble in absolute alcohol and ether (phosphatides), obtained from the following plants, have been examined. Cereals, *Avena sativa, Lupinus albus, L. luteus, Vicia sativa, Pinus cembra, Picea excelsa, Boletus edulis, Cantharellus cibarius*, also from the leaves of *Aesculus hippocastanum*, pollen of *Alnus viridis, Pinus montana*, and potato. The products obtained from all these sources, with the exception of *Pinus cembra*, when hydrolysed, gave carbohydrates. The actual amount of reducing carbohydrate varied with the different sources; thus *Triticum vulgare* gave 16%, *Lupinus albus* 13%, and *L. luteus* only 1%. Even the same material gave varying amounts. Lecithins were also isolated in addition to phosphatides. It is possible that the phosphatides, which gave only small amounts of reducing sugars, contained these in an adsorbed state.

Galactose has been isolated from cereal phosphatide, and the presence of dextrose has been proved, but it has not been settled whether these exist as such in the molecule or are derived from di- and polysaccharides. These phosphatides probably contain other nitrogenous residues in addition to choline. The ratio N : P in the phosphatides is practically the same as in lecithins. J. J. S.

Bio-chemistry of Barley. I. Amylase of Resting Barley. JOHN S. FORD and JOHN M. GUTHRIE (*J. Inst. Brewing*, 1908, 14, 61—85).—The diastatic activity of a barley extract is largely increased when the digestion of the barley with water is carried out in presence of (1) a salt, such as sodium or potassium chloride, potassium sulphate, potassium dihydrogen phosphate, or calcium sulphate; (2) glycine, asparagine, or α-alanine, or (3) a proteolytic enzyme, such as bromelin, animal trypsin, or active or inactive papain. These substances apparently bring about the dissolution of an insoluble, partially occluded enzyme, whilst in the case of papain, with which the increase in diastatic activity is especially marked, the amphoteric proteins present tend to prevent the destruction of amylase, which takes place under other conditions of extraction.

It is further found that considerable increase of amylolytic activity is exhibited by the filtered extract of barley, digested for twenty hours with water containing an antiseptic at 30—35°, instead of for one hour at 18°, as in the ordinary aqueous extraction; this increased activity the authors term "autodigestion activity." The "aqueous extraction" and "autodigestion" values represent the algebraic sum of solution and destruction of the enzyme under the conditions employed, and are not a measure of the amylase, but rather of other substances in the barley. Various unsuccessful attempts have been made to produce a marked increase in the activity of barley extracts, but the results are insufficient to disprove the existence of a zymogenic or inactive soluble variety of translocation diastase.

By far the greater part of the amylase obtained by treatment of barley with active papain is derived from the endosperm, the embryos containing an insignificant quantity. The enzyme apparently permeates the entire amyliferous tissue, but its concentration is far greater in the peripheral zone and aleurone layer than in the innermost parts. The distribution of soluble salts in the barley corn is also irregular, the relative amounts, estimated by measuring the conductivity of their solutions in equal weights of the various parts, being: endosperm, including the aleurone layer, 1, embryo, 4, and husks, 3. Further, the salts in the different parts vary in character, since, in many barleys, the husks are distinctly alkaline to rosolic acid, whilst the reactions of the embryos and endosperms tend towards faint acidity.

When an aqueous extract of barley is shaken with solid starch, a portion of the translocation amylase present is adsorbed by the starch, the filtered extract exhibiting diminished diastatic activity.

The amylolytic activity of barley does not appear to be connected with the hordein or edestin contained in the barley. T. H. P.

Importance of Sodium for Sugar Beet. K. ANDRLÍK and JOSEF URBAN (*Zeitsch. Zuckerind. Böhm.*, 1908, **32**, 208—216).—The percentage of sugar in the roots is high when the roots contain high amounts both of potassium and nitrogen to one of sodium. High amounts of potassium alone in relation to one of sodium are also generally coincident with high percentages of sugar; the relation of potassium to sodium, however, varies during growth. After sixty-six days, roots were found to contain less potassium than sodium, whilst after one hundred and seventy days the relation of potassium to sodium was 1·82 : 1.

The presence of large amounts of sodium in roots is coincident with lower amounts of sugar; it is, however, not established that the greater assimilation of sodium is the cause of diminished sugar production. N. H. J. M.

Nutritive Value of Non-Proteins in Hay. OSCAR KELLNER (*J. Landw.*, 1908, **56**, 49—52).—A criticism of Max Müller's results and conclusions (Abstr., 1907, ii, 645). N. H. J. M.

Humous Carbonate Soils and their Conversion into Grey Sand Soils. A. F. LEBEDEFF (*Bied. Zentr.*, 1908, **37**, 60—61; from *J. exper. Landw.*, 1906, **2**, 591).—Analyses are given of (I) humus-carbonate soils, and (II) transition soils, from humus-carbonate to grey sand, characterised by the complete washing out of the carbonates and by low amounts of humus:

		Humus.	KCl NaCl.	CaO.	MgO.	Al_2O_3.	Fe_2O_3.	SiO_2.	CO_2.
I.	1.	6·71	0·87	32·91	—	4·56	1·58	27·13	22·87
	2.	3·25	0·68	43·37	0·64	4·11	1·23	14·01	32·47
	3.	—	0·38	50·85	0·65	2·11	0·65	4·89	40·26
II.	4.	1·18	2·38	0·90	1·93	10·44		80·96	0·0
	5.	2·10	1·67	0·49	0·85	3·17	1·27	90·04	0·0

N. H. J. M.

Action of Calcium Cyanamide on Different Kinds of Soils. THEODOR REMY (*Bied. Zentr.*, 1908, **37**, 91—93; from *Landw. Jahrb.*, **35**, *Erg.-bd.*, iv., 114).—In pot experiments, 0·07 gram of nitrogen as calcium cyanamide per kilo. of soil was injurious to vegetation, and as little as 0·03 gram was temporarily injurious. In the field, a top dressing of 30 kilos. per hectare was distinctly injurious. The manure acts most favourably on clayey soils, and is then almost equal to sodium nitrate; even considerable amounts are without injurious effect on clay soils.

On sandy soils, the manure may be injurious to seeds, and its action is both slow and incomplete, comparable with that of blood meal.

Calcium cyanamide was found to be without action on the bacteria of heavy soils, whilst on light soils the manure was decidedly injurious. N. H. J. M.

Calcium Cyanamide. CAMILLE ASCHMANN and J. P. AREND (*Bied. Zentr.*, 1908, **37**, 62—63; from *Landw.*, 1906, No. 23).—Experiments with mangolds and barley showed that calcium cyanamide had no poisonous action, and that it acts most quickly on light soils.
N. H. J. M.

Decomposition of Calcium Cyanamide. F. LÖHNIS and A. SABASCHNIKOFF (*Centr. Bakt. Par.*, 1908, ii, **20**, 322—332. Compare Abstr., 1905, ii, 412).—Experiments on the decomposition of the two forms of the manure ("Kalkstickstoff" and "Stickstoffkalk") under different conditions gave almost identical results. The presence of calcium chloride (in "Stickstoffkalk") has, however, some influence on the number of bacteria, other than those which produce ammonia.

Remy's results, indicating that calcium cyanamide has no retarding action on nitrification, were confirmed. N. H. J. M.

Analytical Chemistry.

An Accurate Form of Gas Analysis Apparatus for Commercial and other Purposes. William A. Bone and Richard V. Wheeler (*J. Soc. Chem. Ind.*, 1908, **27**, 10—11).—A modification of Bone's apparatus (Proc., 1898, **14**, 134). The apparatus consists of a water-jacketed combination of measuring and pressure tubes communicating with a mercury reservoir, an absorption vessel standing over mercury in a mahogany trough, and an explosion tube fitted with wires and connected with a separate mercury reservoir. The connexions between the parts of the apparatus are of capillary bore, glass taps being provided where necessary. The principle of measurement adopted is that recommended by Regnault, namely, the measurement of the pressure of the gas under constant volume, and the length of the pressure tube provides for the proper dilution of the "explosive mixture" in an explosion analysis. The absorptions are carried out over mercury in the vessel provided, fresh quantities of the reagents being used for each analysis, and the reagents are removed from the vessel by means of an exhaust pump in connexion with the top of the vessel. The apparatus is particularly adapted to the analysis of mixtures of oxygen with hydrocarbons, and of producer gas, water gas, oil gas, coal gas, &c. W. P. S.

A Problem of Gas Analysis. P. Anema and Charles M. van Deventer (*Chem. Weekblad*, 1908, **5**, 65—74).—Examples of determinate and indeterminate problems in gas analysis are cited.

A. J. W.

Preparation of Normal Hydrochloric Acid with Gaseous Hydrochloric Acid. H. Rebenstorff (*Chem. Zeit.*, 1908, **32**, 99—100).—This is based on Moody's method (Trans., 1898, **73**, 658). Hydrogen chloride is evolved from ammonium chloride in lumps and sulphuric acid, and, after the air has been expelled, the dry gas is passed into a weighed flask containing an exact weight of water. The flask is placed in water, and, when sufficient gas has been absorbed, it sinks to a certain mark, which indicates that an approximately correct N-acid has been obtained. The flask is then re-weighed, and the increase equals the exact amount of hydrogen chloride absorbed. It is then brought to exact normal strength by suitable dilution. L. de K.

Estimation of Chlorates, Bromates, Iodates, and Periodates by means of Formaldehyde, Silver Nitrate, and Potassium Persulphate. HEINRICH BRUNNER and RUDOLF MELLET (*J. pr. Chem.*, 1908, [ii], 77, 33—42).—Grützner's method of estimating chlorates and bromates by heating the salts with formaldehyde, nitric acid, and silver nitrate (Abstr., 1897, ii, 166) is extended to the estimation of iodates and periodates by adding potassium persulphate to the reaction mixture. This addition has the advantage in all cases that it prevents the evolution of free halogen, and hence removes the necessity of working in closed vessels. The analyses quoted show the method to give satisfactory results. A number of experiments are described, showing that chlorates, iodates, and periodates are not reduced by the persulphate in absence of formaldehyde, and that neither hydrogen peroxide nor potassium hydrogen sulphate can be employed in place of the persulphate. Contrary to Grützner's statement, iodates and periodates are reduced, only more slowly than chlorates or bromides, by formaldehyde alone. G. Y.

Estimation of Bromic and Iodic Acids by means of Thiosulphuric Acid. ANGELO CASOLARI (*Gazzetta*, 1907, 37, ii, 609—618. Compare this vol., ii, 173).—Bromic and iodic acids can be estimated in acid solutions with great exactness by means of sodium thiosulphate, the excess of which is determined by titration with iodine. This method may be applied to the determination of the titre of solutions of sodium thiosulphate and iodine, starting from that of potassium bromate or iodate solution of decinormal strength with reference to its oxidising power; it can also be used generally in the volumetric estimation of substances readily reducible in the cold. In the reaction which occurs, tetrathionic acid is formed in almost theoretical proportion; hydrogen sulphide is also evolved, as is the case when other oxidising agents are used. A polythionate containing *m* atoms of sulphur in the molecule generates *m* molecules of sulphuric acid when treated with hydrogen peroxide and sodium hydroxide; polythionates may be estimated by determining the amount of sulphuric acid formed in this way. T. H. P.

Rapid Estimation of Water in Articles of Food, &c. WILHELM THÖRNER (*Zeitsch. angew. Chem.*, 1908, 21, 148—150).—Ten to twenty-five grams of the substance are placed into a round-bottomed distilling flask fitted with a thermometer and connected with a small condenser, in turn connected with a vertical, narrow, graduated cylinder. Fifty c.c. of petroleum are added, and a few pieces of pumice stone are introduced; also, in the case of milk, butter, and cream, a little dry tannic acid. The whole is now distilled, and, when about 18 c.c. of petroleum have passed over, all the water has been expelled, and the volume may then be read off in the bottom part of the graduated tube. L. DE K.

Detection of Ozone, Nitrogen Peroxide, and Hydrogen Peroxide in Gas Mixtures. EDWARD H. KEISER and LEROY MCMASTER (*Amer. Chem. J.*, 1908, 39, 96—104).—A method is described for detecting ozone, nitrogen peroxide, and hydrogen peroxide in presence of one another in mixtures of gases.

If the gas is led through a solution of potassium permanganate, the nitrogen peroxide and hydrogen peroxide are destroyed, whilst the ozone passes through and can be detected by means of potassium iodide and starch. The presence of nitrogen peroxide can be ascertained by passing the gas through a tube containing manganese dioxide, ozone and hydrogen peroxide being decomposed by this reagent, whilst the nitrogen peroxide is not affected and can be detected by means of very dilute permanganate or by passing it into a solution of pure sodium hydroxide and testing for nitrites by the sulphanilic acid and α-naphthylamine method. The presence of hydrogen peroxide can be proved by passing the gas into a solution of potassium ferricyanide and ferric chloride, the solution being rendered first blue and then green by the action of the hydrogen peroxide.

It has been found that, when hydrogen is burnt in air, ozone and nitrogen peroxide are produced together with a very small quantity of hydrogen peroxide. If pure dry air or oxygen is passed through a Siemens' ozoniser, the ozonised gas does not contain either nitrogen peroxide or hydrogen peroxide. The gas produced by the action of strong sulphuric acid on barium dioxide contains ozone, but not hydrogen peroxide or nitrogen peroxide. Ozone and nitrogen peroxide are formed by the slow oxidation of phosphorus in moist air, but hydrogen peroxide is not produced. By the action of the flaming electric arc on air, nitrogen peroxide, a little hydrogen peroxide, and traces of ozone are formed. A sample of ordinary air which was examined was found to contain ozone, but neither nitrogen peroxide nor hydrogen peroxide was present. E. G.

Estimation of Sulphur in Iron and Steel. ÉMILE JABOULAY (*Chem. Zentr.*, 1907, ii, 1444—1445 ; from *Rev. gen. chim. pure. appl.*, 1907, **10**, 193—195).—Five grams of the metal are dissolved in 100 c.c. of dilute hydrochloric acid (1 : 1) in a current of hydrogen, and the gas evolved is burnt in a mixture of air and oxygen. The sulphur dioxide formed is absorbed in a cylinder containing a known amount of hydrogen peroxide, and the excess of this may then be titrated with permanganate, or the sulphuric acid formed may be estimated gravimetrically. The hydrogen peroxide may be preserved by adding 20 c.c. of nitric acid to one litre of its 12% solution.

For exact details and figure of the apparatus, the original communication should be consulted. L. DE K.

Colorimetric Estimation of Nitrogen in Soils: the Nessler Test. D. CHOUCHAK and ISIDORE POUGET (*Bull. Soc. chim.*, 1908, [iv], **1**, 1173—1180).—0·2—0·6 Gram of the carefully prepared sample is mixed with 0·02—0·03 gram of dried oxalic acid, and burnt in the ordinary way with soda-lime in a tube 25—30 cm. long and 0·8—0·1 cm. in diameter. The gases evolved are passed through a kind of small Peligot tube containing 2—3 c.c. of dilute hydrochloric acid. The liquid is then diluted to 50 c.c., and in 5 c.c. of this the ammonia is Nesslerised as usual.

The Kjeldahl process may be employed instead; 5 c.c. of sulphuric acid are used with additions of a small drop of mercury or, preferably, a few decigrams of reduced copper. When cold, the liquid is diluted to 50 c.c.; 5 c.c. are taken, diluted with 20 c.c. of water, and, if mercury has been employed, boiled with a little reduced copper. When cold, a sufficiency of aqueous sodium hydroxide is added and the ammonia is distilled off, the distillate being received in a tube containing a few c.c. of water. The ammonia is then Nesslerised.

In this process, extreme care should be taken to ensure the complete absence of ammonia from any of the reagents, also the absence of nitrates from the soda-lime. L. DE K.

Microchemical Detection of Traces of Arsenic, Antimony, and Phosphorus. BOUWE SJOLLEMA (*Chem. Weekblad*, 1908, **5**, 11—15).—A modification of Gutzeit's test is described, the silver nitrate solution (1 : 1) being placed on a microscope slide held over the test-tube, the reducing action of the filter-paper being thereby eliminated. With arsenic, three forms of lemon-yellow crystals are obtained, 0·005 mg. of As_2O_3 being recognisable. The results for antimony and phosphorus are also characteristic. Mercuric chloride can be substituted for silver nitrate. A. J. W.

Estimation of Arsenic Hydride in Gaseous Mixtures. HANS RECKLEBEN and GEORG LOCKEMANN (*Zeitsch. anal. Chem.*, 1908, **47**, 126—132).—*Gasometric Methods.*—These can be applied only to mixtures containing a large percentage of arsenic hydride. The gas is carefully measured before and after treatment with suitable absorbents (compare this vol., ii, 36). In the presence of methane, for instance, silver nitrate, iodic acid, or hypochlorite solutions may be used; in the presence of ethylene, silver nitrate or iodic acid should be employed, whilst in presence of acetylene, hypochlorite or iodic acid must be used. In presence of saturated and unsaturated hydrocarbons, iodic acid only must be employed.

Gravimetric Methods.—The gaseous mixture is treated with silver nitrate, which is then heated with excess of ammonia. The precipitated metallic silver may then be weighed or, better still, the solution, which now contains the arsenic as ammonium arsenate, may be used for estimating the same by the well-known gravimetric methods. Rohmer's distillation process with hydrocarbons and sulphurous acids (Abstr., 1901, ii, 194) is recommended as a preliminary step.

Volumetric Methods.—The most satisfactory plan is to titrate the arsenious acid obtained by the distillation process by means of standard iodine after removing the sulphur dioxide present by means of a current of carbon dioxide. Traces of arsenic hydride are estimated by passing a measured volume of gas through bromine covered with water. The arsenic is then finally estimated with the Marsh apparatus.
L. DE K.

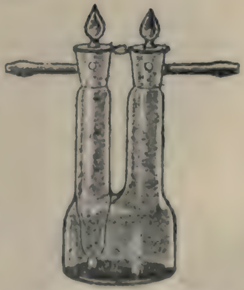
Detection of Arsenic in Sodium Fluoride by means of the Gutzeit and Flückiger Reaction and the Marsh Apparatus. WILLEM VAN RYN (*Pharm. Weekblad*, 1908, **45**, 98—101).—Experiments showing that sodium fluoride may prevent completely the formation of arsenical mirrors in the Marsh apparatus, although the hydrogen evolved may show positively the presence of arsenic by the Flückiger (mercuric chloride) test or by the Gutzeit (silver nitrate) reaction. L. de K.

Estimation of Carbon. Isidore Pouget and D. Chouchak (*Bull. Soc. chim.*, 1908, [iv], **3**, 75–80).—The authors state that in the ordinary method of estimating carbon by complete combustion in a current of air or oxygen in presence of an inorganic oxidising agent, the substitution of a volumetric method of determining the amount of carbon dioxide produced makes it possible to use much smaller quantities of the organic substance, and generally to simplify the operation (compare Loges, Abstr., 1883, 247, 830).

The disposition of apparatus is similar to that usually employed, except that the tube is drawn out to a point at one end, and that the carbon dioxide is collected in a modified form of Winkler's aspirator containing a standard solution of baryta, and suitably connected to a reservoir of mercury so that the pressure can be adjusted during the progress of the combustion. When the whole of the carbon dioxide has been evolved, the pointed end of the tube is connected to a wash-bottle containing a concentrated solution of potassium hydroxide, the point is broken, and air is drawn through the apparatus to sweep the last traces of carbon dioxide into the aspirator. Finally, the baryta solution in the aspirator is titrated with *N*/50 sulphuric acid. Full details of the method of conducting the combustion are given in the original. The method is regarded as particularly suitable for the estimation of carbon in soils. T. A. H.

Estimation of Ash in Graphite. Samuel S. Sadtler (*Chem. Zentr.*, 1907, ii, 1445; from *J. Franklin Inst.*, 1907, **144**, 201—203).—The powdered sample is placed into a platinum crucible, the top diameter of which is a little smaller than the bottom one. A small accurately-weighed quantity of ignited magnesium oxide is added, and the mixture is ignited gradually over the blowpipe in a slow current of oxygen. The addition of magnesium oxide serves to prevent the fusion and agglomeration of the ash. The crucible should be placed at an angle of 30°. L. de K.

Rapid Estimation of Carbon Dioxide in Mineral Waters. J. Stránsky (*Chem. Zeit.*, 1908, **32**, 100—101).—The sample is collected by means of a capillary tube in a cylinder containing some ether, and the carbon dioxide is titrated as usual with *N*/10 potassium hydroxide with phenolphthalein as indicator. The capillary tube attached to the burette dips into the aqueous layer. Escape of carbon dioxide is thus prevented. L. de K.



Soda-lime Apparatus for Organic Analysis and Carbon Dioxide Estimation. Max Dennstedt (*Chem. Zeit.*, 1908, **32**, 77).—The apparatus will be readily understood from the accompanying illustration. It may be made of thin glass, and its weight when empty need not exceed 50 grams. It is loosely filled with about 50 grams of granulated soda-lime, which, if too dry, should be moistened with a few c.c. of water. L. DE K.

Estimation of Carbon Disulphide in Benzene. ISIDORE BAY (*Compt. rend.*, 1908, **146**, 132).—The white, crystalline precipitate of phenylhydrazine phenylthiocarbazate, $CS_2(NHPh\cdot NH_2)_2$, obtained by addition of phenylhydrazine to carbon disulphide, is sufficiently stable to allow it to be employed as the basis of a method of estimating carbon disulphide.

The precipitation is complete in two to three hours. The precipitate is collected on a double tared filter, washed with benzene, and dried in a vacuum desiccator. The method gives very accurate results when estimating carbon disulphide in benzene, the greatest error observed being less than 0·5% of the amount determined, the values being always too high. E. H.

Use of Borax, &c., Beads in Analysis. OSCAR LUTZ (*Zeitsch. anal. Chem.*, 1908, **47**, 1—36).—The author has compared the colorations produced by various elements when the latter are fused in the ordinary way on borax and phosphate beads, and finds that borax beads are only suitable for use in the case of basic elements, such as chromium, manganese, iron, cobalt, nickel, copper, tin, and cerium. For acid-forming elements, such as titanium, vanadium, molybdenum, tungsten, and uranium, phosphate beads give the better results. The bead reactions are at best only confirmatory tests, and in most cases better tests are available. W. P. S.

Electrolytic Analysis. ALEXANDER CLASSEN (*Zeitsch. Elektrochem.*, 1908, **14**, 33—34). ARTHUR FISCHER (*ibid.*, 34—36).—Claims for priority in reference to several methods recently brought forward in papers dealing with this subject. T. E.

Volumetric Estimation of Zinc according to Schaffner. V. HASSREIDTER (*Zeitsch. angew. Chem.*, 1908, **21**, 66—69).—A criticism of Schaffner's zinc titration process with sodium sulphide. The retention of zinc by the ferric hydroxide may be much lessened by washing the precipitate with dilute ammonia instead of water. Excess of ammonia has been supposed to have an injurious effect when applying the spot-test on lead-paper, but the author thinks this is caused by too high a temperature of the solution, also by a large excess of ammonium salts. The analysis of the ore and the checking of the sodium sulphide solution should be carried out simultaneously with the aid of two separate burettes. It also appears that the richer the ore the less chance there is of discrepancies in duplicate commercial analyses. L. DE K.

Electrolytic Separation of Silver and Copper. HORACE W. GILLETT (*J. Physical Chem.*, 1908, **12**, 26—27).—Silver may be determined satisfactorily in presence of copper if the following conditions are observed: total silver and copper about 0·25 gram in the form of nitrates, 7 grams of tartaric acid, 25 c.c. of ammonia, D 0·9, water up to 120 c.c., voltage 1—1·35. The electrolysis may be carried out either at 70° or 20°, but at the lower temperature a very rapid rotation of the anode is necessary so as to get a firmly adhering deposit.

From the liquid the copper may be precipitated as sulphide, which is then redissolved in nitric acid and deposited by electrolysis in the usual way. L. DE K.

Electrolytic Estimation of Minute Quantities of Copper. E. E. FREE (*J. Physical Chem.*, 1908, **12**, 28—29).—The author states that it is possible to estimate fractions of a milligram of copper with accuracy by electrolysis if care is taken to work with a small electrode weighing about 0·3 gram, and with the aid of a delicate assay-balance. The electrode is weighed after the copper has been deposited, and then again after its removal by means of nitric acid.

Good results are obtained by using 25 c.c. of copper solution acidified with 2—4% of nitric acid and a few drops of sulphuric acid. The electrolysis should last overnight with a current of about 1·8 volts and 0·01 ampere. The usual precautions are taken. L. DE K.

Volumetric Estimation of Mercury in its Ores. JOSEPH A. MULLER (*Bull. Soc. chim.*, 1908, [iv], **1**, 1169—1173).—A quantity of the powdered ore, representing about 1 gram of metal, is dissolved in nitro-hydrochloric acid at a gentle heat and then evaporated to dryness at 50°. The residue is dissolved in hot water, 50 c.c. of 20% potassium iodide are added, and then a solution of sodium carbonate so long as a precipitate is formed. After adding a slight excess of 20% aqueous sodium hydroxide, the liquid is filtered, the residue is again extracted a few times with alkaline potassium iodide solution, and finally well-washed with hot water; when cold, the solution is made up to 100 c.c.

Ten c.c. of the solution are then placed in a stoppered flask, 20 c.c. of 20% aqueous sodium hydroxide are added, also 20 c.c. of 35% formaldehyde, and the whole is kept for twenty hours at 25°. This causes the precipitation of metallic mercury, which is carefully washed with alcohol and dissolved in a known measure of standard iodine solution. The excess of iodine is titrated with standard thiosulphate.

Gold or platinum should be absent, as they are also reduced by formaldehyde. L. DE K.

Volumetric Estimation of Lead [as Sulphide]. HUGO KOCH (*Chem. Zeit.*, 1908, **32**, 124—125).—Lead may be estimated with sufficient accuracy by titrating the dilute solution with standard sodium sulphide until no further precipitate is formed. Addition of carbon tetrachloride causes a rapid separation of the precipitate, leaving the aqueous layer quite colourless. Lead sulphate should be dissolved in solution of ammonium acetate.

Sodium sulphide solution keeps well in an atmosphere of coal-gas. L. DE K.

Red Leads and their Examination. ALFRED PARTHEIL (*Arch. Pharm.*, 1907, **245**, 683).—The author's results (this vol., ii, 69) have, for the most part, already been obtained by Reinsch (*Apoth.-Zeit.*, 1907, 195). G. B.

Assay of Red Lead. JULIUS F. SACHER (*Chem. Zeit.*, 1908, **32**, 62—63).—The sample is digested with water and a sufficiency of nitric acid with addition of formaldehyde until the lead peroxide is decomposed; hydrogen peroxide may also be used, but sugar, oxalic acid, alcohol, and lactic acid cannot be recommended, as they may lead to the formation of insoluble lead oxalate. The solution is then evaporated to dryness, the lead nitrate is dissolved in water, and the insoluble matter is collected and weighed. L. DE K.

Assay of Red Lead. ERNST PIESZCZEK (*Pharm. Zeit.*, 1908, **53**, 87—88).—A criticism of Sacher's process (preceding abstract). The author cannot recommend the reduction by means of formaldehyde as the action is too violent. Hydrogen peroxide causes no such inconvenience, and it is not necessary, as recommended by Sacher, to remove the excess of nitric acid by evaporation, as red lead is not likely to contain lead sulphate. The solution should be tested also for calcium.
L. DE K.

Volumetric Estimation of Manganese in Steel. LUIGI SACERDOTI (*Chem. Zentr.*, 1907, ii, 1448; from *L'Industria Chimica*, 1907, **7**, 258—259).—A modification of Deshay's process. 0·2 Gram of borings is boiled with 45 c.c. of nitric acid, D 1·18, until no more nitrous fumes are evolved, 40 c.c. of water are added, and, after heating to boiling, 1·5—2 grams of lead peroxide are added. After boiling for another two minutes, the liquid is rapidly cooled, diluted to exactly 100 c.c., and filtered through asbestos. Fifty c.c. of the filtrate are then diluted with 50 c.c. of water, and the permanganate present is titrated with standard solution of sodium arsenite, which has been checked by means of a steel containing an accurately known percentage of manganese. L. DE K.

Titration with Permanganate in Presence of Hydrochloric Acid. THOMAS W. HARRISON and F. MOLLWO PERKIN (*Analyst*, 1908, **33**, 43—47).—Owing to the reducing action of hydrochloric acid on permanganate, the authors find that the latter cannot be used for the titration of solutions of ferrous salts containing even small quantities of this acid. The addition of substances, such as potassium sulphate, magnesium sulphate, borax, sodium acetate, mercuric sulphate, manganous sulphate, and phosphoric acid, some of which have been stated to have a retarding action on the reduction due to the hydrochloric acid, had no effect on the results, except in the case of manganous sulphate. This salt appeared to have a distinct retarding action, but, owing to the yellow colour of the solution, the end point of the titration was distinguished with difficulty. W. P. S.

Volumetric Estimation of Iron in Ferric Compounds. M. M. PATTISON MUIR (*Chem. News*, 1908, **97**, 50).—The process is based on the fact that addition of mercuric chloride to a mixture of zinc and dilute sulphuric acid stops the evolution of hydrogen.

The iron solution is placed in a flask fitted with a cork carrying a glass tube narrowed at its upper end. Two hundred c.c. of dilute sulphuric acid and 20 grams of iron-free granulated zinc are introduced, the liquid is warmed until there is a brisk evolution of hydrogen, and the flask is shaken from time to time until the reduction is complete. One hundred c.c. of strong mercuric chloride solution are now added, and, after shaking for a few minutes, the contents are cooled rapidly and at once titrated with standard permanganate. L. DE K.

Application of Sodium Hyposulphite in Volumetric Analysis. HERMANN BOLLENBACH (*Chem. Zeitsch.*, 1908, **32**, 146—148).—Sodium hyposulphite, now obtainable in a fairly pure solid condition, has already been used in volumetric estimations. The author gives another instance where it may be successfully applied.

Estimation of Ferric Iron.—The dilute iron solution, the temperature of which should not exceed 30°, is acidified with dilute sulphuric acid until the yellow colour has disappeared. After adding a few drops of potassium thiocyanate, the standardised hyposulphite is added until the red colour has nearly vanished. A few drops of indigo solution are then added, and the titration continued until the liquid is colourless. No notice should be taken of the fact that the solution soon turns blue again.

The hyposulphite solution, which may vary in strength from 2·5 to 30 grams per litre, is checked with a solution of ferrous-ammonium sulphate previously oxidised by means of permanganate. During the titration, the nozzle of the burette should dip into the liquid. A burette arrangement is described in which the hyposulphite is kept in a reservoir, in an atmosphere of either hydrogen, coal-gas, or carbon dioxide. L. DE K.

Separation and Estimation of Cobalt and Nickel. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 66—67).—In the method proposed, the nickel is separated as ammonium-nickel molybdate. The solution containing the nickel and cobalt is rendered faintly acid, an excess of saturated ammonium molybdate solution is added, and then a quantity of ammonium chloride. The mixture is heated to a temperature of 80°, next cooled to 0°, and the precipitate, consisting of ammonium-nickel molybdate, is collected on a filter and washed with cold saturated ammonium chloride solution. The double salt is then dissolved in hot water, the solution is boiled, after the addition of sodium hydroxide, to remove the ammonia, and the nickel is precipitated by the addition of bromine. The hydrated nickel sesquioxide obtained may be weighed or dissolved in a suitable acid, and the nickel deposited electrolytically. The cobalt in the filtrate from the double salt is also precipitated by the addition of bromine in the presence of sodium hydroxide. The results obtained by the method are stated to be trustworthy. W. P. S.

Detection and Estimation of Nickel in Presence of Cobalt, Iron, and Manganese. M. EMMANUEL POZZI-ESCOT (*Compt. rend.*, 1907, **145**, 1334—1335).—The neutralised solution, freed from alkaline earths by addition of ammonium sulphate, is mixed with a large excess of ammonium chloride and a saturated solution of ammonium molybdate, which on heating at 80—90° for a few minutes completely precipitates the nickel and practically all the iron as double molybdates, whilst cobalt and manganese are not precipitated.

The precipitate is well washed with saturated ammonium chloride solution, and the filter is then placed in a beaker containing water. This is heated to boiling, and ammonium chloride and ammonia are added. The iron is precipitated, and the nickel is completely dissolved, and may at once be estimated colorimetrically; or the metal may be precipitated by boiling with excess of potassium hydroxide, and then adding bromine. The sesquioxide is then redissolved, and the nickel precipitated by electrolysis. L. DE K.

Detection of Nickel. HERMAN GROSSMANN and BERNARD SCHÜCK (*Bull. Soc. chim.*, 1908, [iv], **3**, 14—15).—The reaction described by Pozzi-Escot (Abstr., 1907, ii, 818) for the detection of nickel in presence of cobalt is not new, since Markwald (*Inaug. Diss. Berlin*) has already observed that nickel molybdate is less soluble than cobalt molybdate, and that the latter is precipitated much more rapidly than the former, especially in presence of excess of ammonium molybdate.

The reaction is, however, unsuitable for the detection of nickel in presence of cobalt, since salts of the latter, when warmed with excess of ammonium molybdate, yield a precipitate of the anhydrous violet molybdate. The reaction is therefore less delicate as a test for nickel than those described by the authors (Abstr., 1906, ii, 903), Tschugaeff (Abstr., 1907, ii, 989), and Brunck (*ibid.*). T. A. H.

Volumetric Estimation of Nickel. H. CANTONI and M. ROSENSTEIN (*Bull. Soc. chim.*, 1908, [iv], **1**, 1163—1169).—Nickel may be conveniently titrated with potassium ferrocyanide or ferricyanide, using ferric chloride (or uranium acetate) or ferrous sulphate as indicator. The end reaction is determined by placing a drop of the solution on a piece of folded filter paper and applying the spot-test on the paper below. The best results are obtained with ferricyanide in solutions faintly acidified with acetic acid.

The ferro- or ferri-cyanide solution should be checked with a known weight of electrolytically-deposited metal, under the same conditions as in the analysis of the sample. Tables are given showing the influence of acetic acid, sodium acetate, ammonium acetate, sodium sulphate, potassium sulphate, and ammonium sulphate. L. DE K.

New Colour Test for Molybdenum. WILLIAM BETTEL (*Chem. News*, 1908, **97**, 40).—The solution to be tested is evaporated nearly to dryness, carefully neutralised with nitric or sulphuric acid, and mixed with hydrogen peroxide solution. If this should give a yellow coloration, a drop of dilute ammonia is added, when should molybdenum be present, a brownish-red colour will appear. The colour, however, is discharged on dilution and by adding excess of alkali. Accurate quantitative colorimetric results cannot be obtained by this process.

L. DE K.

Separation of Tungstic Acid from Phosphoric Acid. GEORG VON KNORRE (*Zeitsch. anal. Chem.*, 1908, **47**, 37—57).—Tungstic acid may be separated almost quantitatively from phosphoric acid by precipitation with benzidine hydrochloride (compare Abstr., 1905, ii, 286). The solution containing the phosphotungstate is diluted to a volume of about 400 c.c., 3 c.c. of hydrochloric acid, D 1·12, are added, the mixture is boiled, and a sufficient quantity of benzidine hydrochloride is introduced. When cold, the precipitate is collected on a filter, washed with dilute benzidine hydrochloride solution, and then boiled with 200 c.c. of water in order to remove remaining traces of benzidine phosphate. After again cooling, the precipitate is collected, washed as before, ignited in a platinum crucible, and weighed as tungsten trioxide. Benzidine phosphates are not very soluble in water, and for this reason tolidine hydrochloride may be used for the above separation; tolidine phosphates are readily soluble, so that the precipitate of tolidine tungstate does not need to be boiled with water. In other respects, the process is carried out as described for use with benzidine hydrochloride. Should it be desired to remove any traces of phosphate which may remain in the precipitate, the ignited residue is fused with alkali, and the tungsten then re-precipitated with tolidine hydrochloride. W. P. S.

Detection of Ruthenium in Platinum Alloys. N. A. ORLOFF (*Chem. Zeit.*, 1908, **32**, 77).—A portion of the alloy is fused with lead, the regulus is extracted with nitric acid, and the residue ignited in contact with the air to remove any osmium. The mass, consisting of platinum, iridium, rhodium, and ruthenium, is fused with potassium hydroxide and nitrate, dissolved in water, and treated with nitric acid in excess. When this operation is carried out in an Erlenmeyer flask, or simply a test-glass, covered with a piece of filter paper, this will gradually (12—24 hours) darken, owing to the formation of RuO_4 vapours. The paper may then be ignited, the ash fused with potassium hydroxide and nitrate, and the orange-coloured ruthenate extracted with water. L. DE K.

Analysis of Natural Mineral Waters. MAX ROLOFF (*Zeitsch. öffentl. Chem.*, 1908, **14**, 53—58).—The author protests against the use of an undue number of decimals in recording the results of analyses of mineral waters. He instances a case in which the total amount of mineral matter in a litre of water is given to six decimal places. In the light of modern knowledge, the practice of combining the bases and acids, found on the analysis of a water, to show that certain salts are present in the water is also open to objection.

W. P. S.

Improved Method for Estimating the Acidity of Soils. H. SÜCHTING (*Zeitsch. angew. Chem.*, 1908, **21**, 151—153).—Ten to fifty grams of the soil are mixed with a little water contained in a flask, an accurately weighed quantity (about 0·4 gram) of calcium carbonate is added, and the carbon dioxide evolved is removed by means of a current of hydrogen with constant stirring of the mass.

The carbon dioxide is absorbed and titrated (Pettenkofer's process), but this may, as a rule, be omitted.

Dilute hydrochloric acid is now added, and the carbon dioxide evolved determined as before. The difference between the result and the figures calculated from the calcium carbonate added equals the carbon dioxide expelled by the acids from the soil.

If the sum of the carbon dioxide found by the two processes exceeds that of the amount added, the excess is due to carbon dioxide formed by decomposition of organic matters. In accurate analysis, this should be allowed for. L. DE K.

A New Dephlegmator for the Fractionation of Naphtha. V. F. HERR (*Chem. Zeit.*, 1908, **32**, 148—149).—The apparatus consists of a tube or column, which may be conveniently made from the outer jacket of a Liebig's condenser (300—1000 mm.) by removing the water-inlet tube; the outlet tube is then connected with a condenser. After placing a disc of wire gauze at the bottom, the column is filled with shot, and a thermometer is fixed in with its bulb just opposite the outlet tube. The whole is held in position by means of a ring lined with asbestos, and a round-bottomed, short-necked distillation flask is attached. The column is isolated by means of cotton-wool, filter paper, and asbestos. If fractions above 130° should have to be collected, the 1000 mm. column should be surrounded by a thin asbestos covering only, and then be placed in a jacket made of strong sheet copper, which is heated by means of four burners to the desired temperature.
L. DE K.

Observations on the Analysis of Lavender Oils. PAUL JEANCARD and CONRAD SATIE (*Bull. Soc. chim.*, 1908, [iv], 3, 155—159).—This work has been in progress since 1900 to ascertain how the percentage of esters in lavender oils is affected by (1) the altitude at which the plants are grown, and (2) the conditions under which the distillation is conducted.

The results confirm the observations recorded previously (Abstr., 1900, i, 510), and show in addition that the most important factors in ascertaining the value and freedom from sophistication of a lavender oil are (*a*) the acid number, (*b*) specific gravity (0·880 to 0·890), (*c*) rotatory power (−6° to −10° in a 100 mm. tube), and (*d*) saponification number after acetylation (above 160). The addition of spike oil increases the second and diminishes the third and fourth of these constants. The principal constants of lavender oils produced in (1) the higher Alps, and (2) in the Italian Alps in recent years, are tabulated in the original. T. A. H.

Estimation of Esters in Wine. GÉZA AUSTERWEIL and PAUL PACOTTET (*Chem. Zeit.*, 1908, **32**, 112—113).—One hundred to two hundred and fifty c.c. of the carefully-neutralised wine are distilled in a special apparatus at the temperature of boiling ether or ethyl bromide under reduced pressure until about one-third of the liquid has passed over. The distillate is then boiled in a reflux apparatus for one hour with 10 c.c. of $N/10$ potassium hydroxide, when the excess of

alkali is titrated with $N/10$ sulphuric acid. The result is expressed in ethyl acetate. One c.c. of $N/10$ alkali $=0{\cdot}0088$ gram of the same.
L. DE K.

Evaluation of Picric Acid. FRANZ UTZ (*Zeitsch. anal. Chem.*, 1908, **47**, 140—144).—0·1 Gram of the sample is heated in a flask with 5 c.c. of 30% aqueous sodium hydroxide and 10 c.c. of 3% hydrogen peroxide for twenty to thirty minutes. The water evaporated is replaced from time to time, and a few drops of hydrogen peroxide are also added occasionally. In this manner, the nitrogen is converted into nitrite; 40 c.c. of water and 100 c.c. of 3% hydrogen peroxide are now added, the temperature is raised to 80°, and 40 c.c. of 5% sulphuric acid are introduced by means of a pipette reaching to the bottom of the flask. After heating once more to 80%, 12 c.c. of 10% solution of nitron in 5% acetic acid are added, and on cooling, the nitric acid formed is precipitated as nitron nitrate. After placing the flask for an hour in iced water, the precipitate is collected by aid of a filter pump, washed with 10—12 c.c. of iced water, dried at 105°, and weighed. One gram $=0{\cdot}037406$ gram of nitrogen. L. DE K.

Estimation of *m*-Cresol in Cresol Mixtures. FRITZ RASCHIG (*Pharm. Zeit.*, 1908, **53**, 99—100).—A reply to Herzog, who seems not to have followed the author's directions (Abstr., 1900, ii, 694), and has, in consequence, obtained incorrect results with high-grade cresols.

The process consists in converting the *m*-cresol into insoluble trinitro-*m*-cresol, and oxidising the *o*- and *p*-cresol with formation of oxalic acid and other soluble substances. L. DE K.

Analysis of Crude Cresols. JOHANNES HERZOG (*Pharm. Zeit.*, 1908, **53**, 141).—The method of estimating *m*-cresol in mixtures of cresols described by Raschig (preceding abstract) is not considered by the author to be a suitable one for use by pharmacists. A good fume-cupboard is required in which to carry out the process, and the results obtained do not appear to be always trustworthy. W. P. S.

Estimation of Cineol (Eucalyptol) in Eucalyptus Oils. OTTO WIEGAND and M. LEHMANN (*Chem. Zeit.*, 1908, **32**, 109—110).—The process described previously by the authors is now applied to the fraction passing over between 170—180°. Ten c.c. of the distillate are shaken vigorously, as directed, with excess of 50% resorcinol solution, and the amount of cineol absorbed may thus be read off and calculated on the original quantity taken for analysis. L. DE K.

Colour Reaction of Cholesterol on Oxidation. ISAAC LIFSCHÜTZ (*Ber.*, 1908, **41**, 252—255).—The recognition of oxycholesterol in bone fat, blood (Abstr., 1907, ii, 899), brain, and pancreatic fat has led to the study of its colour reactions. When a few grains of benzoyl peroxide are added to an acetic acid solution of a few mg. of cholesterol, the whole warmed, then cooled, and four drops of sulphuric acid added to the mixture, a beautiful green or violet-red colour, changing to green, is developed. The sensitiveness of this reaction is 1 in 10,000 in layers of 12—15 mm. Although less sensitive than

Liebermann's reaction (Abstr., 1885, 1075), it has the advantage that the absorption bands are situated between the lines *C* and *d*, whereas in the other the bands are situated near *B* and resinification, caused by the acetic anhydride, may mask the colour. The colours are due to oxycholesterol or the ether (Abstr., 1907, i, 315, and *loc. cit.*); oxycholesterol is best prepared by using benzoyl peroxide.

A combination of the above test for oxycholesterol and Liebermann's test for cholesterol is made by first adding sulphuric acid to an acetic acid solution; the green colour produced by oxycholesterol is destroyed by acetic anhydride, and if cholesterol is present the characteristic colour due to this substance is developed. W. R.

Titration of Formaldehyde in Highly-Coloured Solutions. SÖRÉN P. L. SÖRENSEN and H. JESSEN-HANSEN (*Biochem. Zeitsch.*, 1908, 7, 407—420).—Formaldehyde may be titrated with alkali and phenolphthalein as indicator even if the liquid should be coloured yellow or yellowish-brown, but in such case it is advisable to make a check experiment using water judiciously coloured with tropæolin and Bismarck-brown (*ibid.*, 1907, 64). But even this device fails when the solution is too dark coloured, as in the case of protein decomposition products. In this case, the authors operate as follows: 20 c.c. of the solution are acidified with, say, 5 c.c. of $N/2$ hydrochloric acid (if there is already excess of acid it may be advisable to add $N/2$ sodium hydroxide instead), 4 c.c. of $2N$ barium chloride are added, and then, with constant shaking, 20 c.c. of $N/3$ silver nitrate; the silver chloride formed precipitates most of the colouring matter. After making up the volume to 50 c.c. and adding four drops more water, the liquid is filtered and an aliquot part is used for the usual titration, allowance being made for acid or alkali added. L. DE K.

Testing the Purity of Salicylaldehyde. HANS KREIS (*Chem. Zeit.*, 1908, **32**, 149).—When applying Komarowsky's test for amyl alcohol in spirits, it is necessary to make sure as to the purity of the salicylaldehyde employed. If alcohol free from fusel oil is available, it is easy to make a practical test, but if not, the following test is recommended: three drops of the sample are mixed with ten drops of sulphuric acid. Pure salicylaldehyde turns a clear, orange-red, whilst unsuitable preparations give more or less dark brownish-red colorations. If now 5 c.c. of 95% alcohol are added, the pure substance gives a colourless solution, whilst the impure samples give red solutions of varying intensity. L. DE K.

Use of *p*-Nitrophenylhydrazine in the Identification of Aliphatic Ketones and Aldehydes. HENRY D. DAKIN (*J. Biol. Chem.*, 1908, **4**, 235—238).—In the identification of small quantities of simple aldehydes and ketones, *p*-nitrophenylhydrazine is of great service; it gives compounds which are insoluble in water and easily crystallisable. The melting points of the phenylhydrazones of the following substances are given thus: formaldehyde, 181—182°; acetaldehyde, 128—128·5°; propaldehyde, 123—124°; *n*-butaldehyde, 91—92°; *iso*butaldehyde, 131·5—132°; *iso*valeraldehyde, 109—110°; glyoxylic acid, about 200°;

acetone, 149°; methyl ethyl ketone, 128—129°; methyl *iso*propyl ketone, 108—109°; methyl *n*-nonyl ketone, 90—91°. W. D. H.

Estimation of Acetone. GUNNAR HEIKEL (*Chem. Zeit.*, 1908, **32**, 75—76).—Both Messinger's process (titration with iodine in alkaline solution) and Denigès's mercuric sulphate method give concordant results. Should a serious difference be noticed, the acetone contains substances which interfere with the tests. In the case of almost pure acetone, the mercury precipitate is yellowish-white, but with inferior samples, it is yellowish-brown, or nearly brown. L. DE K.

Normal Tubes for Saccharimeters. HENRI PELLET (*Ann. Chim. anal.*, 1908, **13**, 56—57).—The author thinks that the use of the special tubes recommended by Rousset (this vol., ii, 73) would tend to lead to confusion and require alterations in some of the instruments now employed. W. P. S.

Estimation of Pentoses in Urine. ADOLF JOLLES (*Zeitsch. anal. Chem.*, 1907, **46**, 764—771).—The urine is freed from interfering volatile substances by boiling with a few drops of acetic acid and if necessary concentrated. One hundred c.c. of the sample are mixed with 150 c.c. of hydrochloric acid, D 1·06, and distilled in a current of steam until the distillate measures, say, 1 litre. One hundred c.c. of the distillate are then over neutralised with 20% sodium hydroxide solution, using methyl-orange as indicator, and *N*/2 hydrochloric acid is again added until the red colour is permanent.

The furfuraldehyde which represents the pentose is then estimated in the usual way by titration with sodium hydrogen sulphite and standard iodine solution. L. DE K.

Barfoed's Acid Cupric Acetate Solution as a Means of Distinguishing Dextrose from Maltose, Lactose, and Sucrose. F. C. HINKEL and HENRY C. SHERMAN (*J. Amer. Chem. Soc.*, 1907, **29**, 1744—1747).—Barfoed's copper solution is made by dissolving 45 grams of crystallised copper acetate in 900 c.c. of water, 1·2 c.c. of 50% acetic acid is added, and the whole is diluted to a litre. Five c.c. of the reagent are then placed in a test-tube, 5 c.c. of the sugar solution are added, and the tube is placed in boiling water for ten minutes. Any reduction is due to dextrose only. The author has investigated this method, but states that in order to get trustworthy results the amount of dextrose should not exceed 2 mg., as otherwise the reduction is incomplete. The filtrate may then be tested for the other sugars. L. DE K.

Estimation of Sugar in Blood. IVAR BANG (*Biochem. Zeitsch.*, 1908, **7**, 327—328).—Blood is received from the animal into excess of alcohol; the coagulum is broken up, and then separated by repeated centrifugalisation with alcohol. The alcoholic extracts are mixed, concentrated, shaken with a little kaolin, and filtered. The sugar is estimated in the clear filtrate (compare Rona and Michaelis, this vol., ii, 117). W. D. H.

Estimation of Lactose in Milk. CYRILLE CARREZ (*Ann. Chim. anal.*, 1908, 13, 17—22).—When using the author's process, it is not necessary to know the volume occupied by the coagulum. Fifty c.c. of milk are mixed with 5 c.c. of potassium ferrocyanide solution (150 grams per litre) and then with 5 c.c. of zinc acetate solution (300 grams per litre), and the clear filtrate is then examined polarimetrically. The operation is repeated three times, addition of 10, 25, and 50 c.c. respectively of water being made to the milk. Formulæ are given explaining the calculation of the % of lactose. L. DE K.

The Polarimetric Determination of Sucrose. The Effect of Clarification with Basic Lead Acetate on the Optical Activity and Copper Reducing Power of Sugar Solutions. FRANCIS WATTS and HAROLD A. TEMPANY (*J. Soc. Chem. Ind.*, 1908, 27, 53—57).—The authors find that the use of excessive amounts of basic lead acetate has an appreciable effect on the optical activity and reducing power of solutions of invert-sugar. When such an excess is avoided, clarification by means of dry anhydrous basic lead acetate involves no such error (compare Abstr., 1907, ii, 656). In the case of low grade products, such as molasses, trustworthy results are obtained by clarification with dry anhydrous basic lead acetate, followed by treatment with sulphur dioxide; this especially applies to estimations by Fehling's method. The authors consider that it appears to be unnecessary to search for more complicated methods of clarification, since the use of dry anhydrous basic lead acetate gives results which are well within the limits of accuracy of ordinary methods of analysis.

W. P. S.

Detection of Rice Starch in Wheat Flour. PELTRISOT (*Ann. Chim. anal.*, 1908, 13, 50—53).—The method described by Gastine (Abstr., 1907, ii, 137) is considered to be of value in the detection of rice starch in wheat flour; the appearance of the hilum of the starch grain is characteristic. As, however, a few other starch grains, notably those of darnel, may be mistaken for rice, care should be taken to avoid an error of judgment. Whenever possible, the character of the pericarp should be taken into consideration. W. P. S.

Estimation of Crude Fibre and Separation of Cellulose, Lignin, and Cutin. JOSEF KÖNIG (*Ber.*, 1908, 41, 46—49. Compare Abstr., 1906, ii, 905).—Polemical. A reply to Matthes and Streitberger (Abstr., 1907, ii, 991). W. H. G.

Estimation of Crude Cacao Fibre. HERMANN MATTHES (*Ber.*, 1908, 41, 400—403. Compare Matthes and Streitberger, Abstr., 1907, ii, 991).—Polemical. A reply to König (preceding abstract).

G. Y.

Solubility of Stearic Acid in Ethyl Alcohol at 0°. WILLIAM H. EMERSON (*J. Amer. Chem. Soc.*, 1907, 29, 1750—1756).—In carrying out some estimations of stearic acid by Hehner and Mitchell's method (Abstr., 1897, ii, 289), difficulty was experienced in obtaining a definite saturated solution of the acid, and a study has therefore been made of its solubility in alcohol at 0°. It has been found that the solubility is practically constant when not less than 0·7 gram is used with 100 c.c. of alcohol or not less than 0·5 gram with 50 c.c., but that, if smaller quantities of the acid are employed, highly supersaturated solutions are produced. The solubility at 0° of the acid in 100 c.c. has been found to be 0·1246 gram in alcohol of 95·7% strength, 0·1223 gram in 95·5% alcohol, 0·1139 in 95·1%, 0·1035 in 94·5%, and 0·0996 in 94·3% alcohol. When an alcoholic solution of stearic acid is evaporated on the water-bath, small quantities of ethyl stearate are produced, and the solubility of the acid therefore appears greater than it actually is. Thus, on evaporating a solution in 99% alcohol, 1·26% of the acid was converted into the stearate. E. G.

Detection of Glyoxylic Acid in Urine. F. Granström (*Beitr. chem. Physiol. Path.*, 1908, **11**, 132—142).—See this vol., ii, 122.

Detection of Tartaric Acid in Cider. G. A. Le Roy (*Compt. rend.*, 1907, **145**, 1285; *Ann. Chim. anal.*, 1908, **13**, 16—17).—An intense violet coloration is produced when tartaric acid or a tartrate is heated with from 10 to 20 times its weight of a 10% solution of resorcinol or pyrogallol in concentrated sulphuric acid. Under the same conditions, citric acid does not give a coloration, and malic and lactic acids yield yellow colorations. For the detection of tartaric acid or its salts in cider, the test is applied as follows: the cider is neutralised and treated with an excess of basic lead acetate solution, the precipitate is collected on a filter, washed with cold water, and then decomposed with hydrogen sulphide. The lead sulphide is separated by filtration, the filtrate is heated to expel the hydrogen sulphide, an excess of sodium hydrogen carbonate is then added, and the solution is evaporated to dryness. The resulting residue is dissolved in a quantity of the resorcinol or pyrogallol solution and the mixture is heated. If tartaric acid is present, a violet coloration will be produced. W. P. S.

Goldenberg Method for the Estimation of Tartaric Acid in Wine Dregs, Tartar, and other Crude Materials. Chemische Fabrik. vorm. Goldenberg, Geromont & Co. (*Zeitsch. anal. Chem.*, 1908, **47**, 57—59).—The following manner of carrying out this process is given: Six grams of the sample containing more than 45% of total tartaric acid, or 12 grams if the tartaric acid content is less than 45%, are digested for ten minutes with 18 c.c. of hydrochloric acid, D 1·10. The mixture is then diluted with water to a volume of 200 c.c., mixed, and the solution is passed through a dry filter. One hundred c.c. of the filtrate are transferred to a beaker of 300 c.c. capacity, in which have been placed previously 10 c.c. of 66% potassium carbonate solution, and the solution is boiled for twenty minutes. The solution together with the precipitated calcium carbonate is then rinsed into a 200 c.c. flask, diluted with water to the mark, mixed, and filtered through a dry filter. One hundred c.c. of the filtrate are evaporated in a porcelain basin on the water-bath to a volume of 15 c.c., 3·5 c.c. of glacial acetic acid are now added, and the mixture is stirred for five minutes. After ten minutes, 100 c.c. of 95% alcohol are added, the stirring is continued for five minutes, and at the end of a further ten minutes the precipitate is collected on a filter and washed with alcohol. The filter and precipitate are next placed in a basin, treated with 200 c.c. of hot water, and the solution is titrated with *N*/5 sodium hydroxide solution, using litmus paper as indicator. The sodium hydroxide solution is standardised with pure potassium hydrogen tartrate. A correction is made for the volume of the insoluble constituents of the crude material; in the case of samples containing less than 45% of tartaric acid, 0·80% is subtracted from the result obtained; for samples containing from 45—60%, the correction is 0·30% and 0·20% for those with from 60—70%. No correction need be applied to the results obtained with samples containing more than 70% of tartaric acid. W. P. S.

Estimation of Non-volatile Organic Acids in Tobacco. JULES TÓTH (*Rev. intern. Falsif.*, 1907, **20**, 165—166).—Further results are given of the estimation of oxalic, malic, and citric acids in tobacco (Abstr., 1907, ii, 513). The quantities found were: oxalic acid, from 0·42 to 2·57%; citric acid, from 0·92 to 4·56%; malic acid, from 1·56 to 7·81%. It is found that by estimating the acids separately and calculating the results into oxalic acid, a value was obtained which was sometimes more and sometimes less than the value obtained by estimating the acids directly by titration, and expressing the result as oxalic acid. The differences were probably due to the influence of the volatile acids present in the tobacco. W. P. S.

Estimation of Fat in Milk. D. SIDERSKY (*Ann. Chim. anal.*, 1908, **13**, 22—24).—The author recommends the process of Soxhlet as modified by Timpe. To 100 c.c. of milk are added, slowly and with gentle shaking, 50 c.c. of sulphuric acid; 50 c.c. of water are then added, and, when cooled to 15°, 60 c.c. of ether are introduced and the whole is well shaken to extract the butter fat. The ether, before use, is well shaken with dilute sulphuric acid (1 : 3).

The percentage of fat is now found by taking the sp. gr. of the ethereal solution and reference to a table. L. DE K.

Estimation of Fat. ELLY A. BOGDANOFF (*J. Landw.*, 1908, **56**, 53—87).—See this vol., ii, 206.

Estimation of the Caprylic [Octoic] Acid Value of Butter-Fat. R. K. DONS (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 75—79).—The process is a modification of that described previously by the author (Abstr., 1907, ii, 824). Five grams of the butter fat are saponified in the usual way, the soap is dissolved in 100 c.c. of hot water, and the fatty acids are liberated by the addition of 50 c.c. of dilute sulphuric acid. After cooling, the aqueous portion is removed, and the solid cake of fatty acids is extracted twice with 150 c.c. of hot water. After this treatment, the cake of fatty acids is placed in a flask, 20 grams of glycerol, 5 grams of sodium sulphate, and a few pieces of pumice stone are added, and the mixture is distilled until 110 c.c. of distillate have been collected. One hundred c.c. of this

distillate are neutralised, as in the usual Reichert-Meissl process. The acidity of the distillate is due almost entirely to caprylic [octoic] acid, and this is precipitated by the addition of $N/10$ silver nitrate solution. The quantity of the latter required, expressed as c.c. of $N/10$ solution, multiplied by 1·1, gives the "caprylic acid" value of the fat. A correction is applied for the solubility of the silver salt in the volume of solution and that of the water used for washing the precipitate (20 c.c.); this correction is 0·4 c.c., which is added to the result obtained. Pure butter-fat gives a value of from 1·6 to 2·0; butter containing 10% of cocoanut oil, from 2·7 to 3·0, and pure cocoanut oil, 5·3.
W. P. S.

Blackberry-seed Oil. RICHARD KRZIZAN (*Chem. Rev. Fett-Harz-Ind.*, 1908, **15**, 7—9, 29—30).—Blackberry seeds yield about 12·6% of a drying oil having the following chemical and physical constants: D^{15} 0·9256; saponification number, 189·5; iodine number, 147·8; acid number, 2·03; insoluble fatty acids, 96·3%. The liquid fatty acids contain about 80% of linolic acid, 17% of oleic acid, and 3% of linolenic and *iso*linolenic acids, and amount to about 91%, reckoned on the oil, whilst the solid acids, chiefly palmitic acid, are about 4·7%. Volatile acids are not present in the oil. The unsaponifiable portion of the oil contains 0·6% of phytosterol. The drying properties of the oil are somewhat inferior to those of raspberry-seed oil (Abstr., 1907, i, 821).
W. P. S.

Staněk's Method for Estimating Choline. VLADIMIR STANĚK (*Zeitsch. physiol. Chem.*, 1908, **54**, 354).—In reply to Kiesel (Abstr., 1907, ii, 994), it is pointed out that most of his observations have been made previously by the author.
J. J. S.

Indicators in the Titration of Cinchona Bases. ERWIN RUPP and K. SEEGERS (*Chem. Zentr.*, 1907, ii, 1363; from *Apoth. Zeit.*, 1907, **22**, 743—750).—Hæmatoxylin may be advantageously replaced as an indicator for cinchona alkaloids by dinitrophenolphthalein, or better still by *p*-nitrophenol, in all cases where the solution is colourless or nearly so. In cases of strongly-coloured liquids, tetrachlorotetrabromophenolphthalein may render good service. The indicators are used in the form of 1% alcoholic solutions, ten to twenty drops of the first, or twenty to thirty drops of the latter, solution. The liquids must be diluted with sufficient alcohol to prevent separation of free alkaloid. Both indicators turn yellow in presence of alkali, and the cinchona alkaloids behave towards them as monobasic compounds.
L. DE K.

Estimation of Ecgonine in Java Coca. ANNE W. K. DE JONG (*Pharm. Weekblad*, 1908, **45**, 42—43. Compare Abstr., 1905, ii, 778).—A criticism of Greshoff's process (Abstr., 1907, ii, 914). The ecgonine hydrochloride obtained is not always pure, but may be contaminated with sodium and, sometimes, ammonium chloride. To prevent this, the "acid-alkaloid" is dissolved in ether and shaken a few times with water, the ether is removed by distillation, and the residue treated according to Greshoff's method. The aqueous solution may still retain some ecgonine; it is therefore boiled, if necessary, with a slight excess of sodium hydroxide to expel the ammonia. It is then acidified with hydrochloric acid, and evaporated to dryness; the result, after allowing for sodium chloride, represents ecgonine hydrochloride.

The composition of the "acid-alkaloid" cannot be calculated, as stated by Greshoff, from the ecgonine hydrochloride, as it is in reality composed of three alkaloids, namely, cocaine, cinnamylcocaine, and *iso*atropylcocaine. L. DE K.

Control and Estimation of Atomic Complexes in Drugs. PIO LAMI (*Boll. chim. farm.*, 1907, **46**, 826—833).—Methods are given for the examination of protargol, heroine (diacetoxymorphine), mesotan (acetylmethyl salicylate, $OH\cdot C_6H_4\cdot CO_2\cdot CH_2\cdot COMe$), aspirin (*o*-acetoxybenzoic acid), aristochin [quinine carbonate,

$$CO(O\cdot C_{20}H_{20}O_{23}N_2)_2],$$

and aristol (iodothymol). T. H. P.

Estimation of Tannins in White Wines. MAX KOEBNER (*Chem. Zeit.*, 1908, **32**, 77).—Ten c.c. of wine are placed in a stoppered cylinder, 10 c.c. of tartaric acid solution (1 : 10) are added, then three drops of ferric chloride (1:10), ammonia in excess, and water up to 50 c.c. A clear solution is obtained which owes its dark colour to a certain amount of iron tannate. The solution is then compared with one made in a similar manner, using a solution of 1 gram of tannin and 50 c.c. of hydrochloric acid made up to 1 litre as a standard comparison fluid.

L. DE K.

The Polariscopic Method for the Estimation of Gliadin. G. W. SHAW (*J. Amer. Chem. Soc.*, 1907, **29**, 1747—1750).—Snyder's process (Abstr., 1904, ii, 524) is recommended. If care is taken to make two polarimetric determinations, the first in the original solution, and the second after precipitating the protein with mercuric nitrate, the results compare favourably with the usual chemical methods.

L. DE K.

The Aloin Test for Hæmoglobin. A. BOLLAND (*Bull. Acad. Sci. Cracow*, 1907, 441—448. Compare Schaer, Abstr., 1903, ii, 344).—The blood stain is extracted for twenty-four hours with 1 c.c. of concentrated ammonia, the ammonia is allowed to evaporate, and the residue is dissolved in 3—4 c.c. of water. After concentration and acidification with 2·6 c.c. of a 0·06% solution of citric acid, 1 c.c. of a 0·1% aloin solution and 1 c.c. of oil of turpentine are added. If hæmoglobin is present, a red coloration is produced in ten to fifteen seconds. As in the case of the analogous guaiacum test, citric acid should be added to exclude ferrous compounds, which may produce a coloration similar to that given by hæmoglobin. G. B.

General and Physical Chemistry.

Index of Refraction of Mixtures of Alcohol and Water. A. G. Doroschewsky and S. V. Dvorschantschik (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 101—125).—The experiments were carried out in a similar manner to those of Wagner and Schultze (Abstr., 1907, ii, 821), although quite independently, and it is pointed out that the results of these investigators are vitiated by the employment of an inaccurate method of reading the temperature. Tables and curves are given showing (1) the change in refractive index for 1° rise in temperature for various compositions. (2) The change in this quantity with change in composition. (3) The refractive index of various mixtures at certain temperatures as observed, and also as calculated from the results of experiment. Employing the values of the refractive indices obtained by experiment, the composition of the mixtures is calculated by the formulæ $(n-1)/d$, $(n^2-1)/d$, $(n^2-1)/(n^2+2)/d$; the first formula gives the best results, but all three yield fairly satisfactory results for weak solutions of alcohol in water or vice versa, but not for solutions of medium strength. Contrary to Kiegler's statement (Abstr., 1896, ii, 224), it is shown that the addition of water to a concentrated solution of alcohol at first greatly raises the index of refraction, and then the effect diminishes, until at the composition 50% water it is zero, and further addition lowers the index; it is also shown that C in Pulfrich's formula (*Zeitsch. physikal. Chem.*, 1889, **3**, 561) $(D-D^1)/D=C.(N^1-N)/N$ is not a constant.

The refractive index method cannot be employed for the accurate determination of the constitution of concentrated solutions of alcohol in water, but for dilute solutions it yields very satisfactory results.

Z. K.

The Swan Spectrum. Karl von Wesendonk (*Physikal. Zeitsch.*, 1908, **9**, 151—154).—The flame of a hydrocarbon burning in an atmosphere of chlorine shows the Swan spectrum, which would indicate that the latter is due to carbon and not to carbon monoxide.

T. E.

Some Infra-red Spectra. W. J. H. Moll (*Arch. Néerland.*, 1908, [ii], **13**, 100—134)—An automatic spectrometer was employed having silvered concave mirrors in place of lenses. The radiation was measured by Rubens' method, using an iron-constantan couple, and an automatic arrangement was employed for making the photographic record of the galvanometer readings. The rotation of the prism being intermittent, the curve on the drum was traced as a series of separate points.

The arc spectra of sodium, potassium, rubidium, and cæsium are tabulated and illustrated by curves, the wave-lengths studied being from $0{\cdot}55\mu$ to 4μ. The spectrum of mercury was examined as far as 10μ, but beyond $1{\cdot}7\mu$ emission could not be detected. The absorption bands of atmospheric air were measured by examining the spectrum of a Nernst lamp. C. H. D.

Ultra-red Emission Spectra of the Alkali [Metals]. A. BERGMANN (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 113—130).—By a combination of the phosphorographic and photographic methods, the author has examined the ultra-red emission spectra of the alkali metals. Phosphorescent screens were prepared from zinc sulphide, obtained by dissolving zinc chloride in water, adding excess of ammonia, precipitating with hydrogen sulphide, and heating the dried product to a moderate white heat. The phosphorescent plates were rendered active by exposing them for one or two minutes to an arc light placed on the further side of a cupriammonium sulphate solution or by exposing them for a few seconds to diffused daylight. They were then subjected to the action of the ultra-red radiation for a few minutes, and then immediately brought into contact with photographic plates. After an exposure of about two hours, the plates were developed.

As source of light, an arc lamp was used, the carbons being axially perforated and filled with the anhydrous chlorides of the alkali metals. The objectives of the collimator and of the camera were specially designed to enable measurements of wave-lengths up to $2000\mu\mu$ to be effected.

Spectral lines in the ultra-red region were obtained as follows, the numbers representing wave-lengths in terms of $\mu\mu$: sodium, 1144·4; potassium, 1177·6 and 1249·4; rubidium, 1322·9, 1344·2, and 1366·8; cæsium, 1359·0 H. M. D.

Spectrum of Magnesium and of the so-called Magnesium Hydride, as Obtained by Spark Discharges under Reduced Pressure. E. E. BROOKS (*Proc. Roy. Soc.*, 1908, **80**, *A*, 218—228).—The spark spectrum of magnesium in hydrogen shows among other features a complex system of bands and flutings extending over a considerable part of the visible spectrum (compare Liveing and Dewar, Abstr., 1881, 957; 1882, 254, 255; 1883, 2; 1889, 89), and these lines and flutings have been provisionally ascribed to the presence of magnesium hydride. The author has investigated the spectra obtained with magnesium electrodes in hydrogen and other gases under reduced pressure, but has not succeeded in elucidating the origin of the so-called hydride spectrum.

Discharges of high frequency (with Leyden jars) and of low frequency with alternating currents have been used, and the results are described in detail. In certain circumstances, with the high frequency discharge, the tube is filled with a green flame, the so-called high frequency flame, the current being then carried by magnesium ions. The hydride spectrum appears always to be obtained with the high frequency flame in hydrogen, even when the gas is dried with phosphoric oxide, but is not obtained with other gases in the absence of water vapour. In the low frequency flame, however, the hydride spectrum is not obtained in perfectly dry hydrogen, although under the same conditions, in the presence of water vapour, it shows distinctly.

The spark spectrum of magnesium in air, nitrogen, and other gases has also been investigated.

In a note appended to the paper, it is mentioned that Fowler has recently observed the "hydride" bands and flutings in the spectra of sun-spots. G. S.

Zeeman Effect for the Helium Lines. WILHELM LOHMANN (*Physikal. Zeitsch.*, 1908, **9**, 145—148. Compare this vol., ii, 152).—All the lines of the helium spectrum are converted into triplets when the glowing gas is placed in a magnetic field and examined at right angles to the lines of force. The distance between the side lines divided by the wave-length squared is the same for all the lines. This is the simplest case foreseen by Lorenz's theory, and it has not been observed in any other substance; it indicates a very simple structure for the helium atom. T. E.

The Arc Spectrum of Cerium. ARTUR BAKOWSKI (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 73—100).—Five cerium preparations, purified by different methods, were found to give identical spectra. A complete table of the lines in the arc spectrum of cerium from λ 2576 to λ 5003 is given, together with identifications of a large number of lines with lines in the solar spectrum.

C. H. D.

Some Phosphorescent Spectra. HENRI BECQUEREL (*Compt. rend.*, 1908, **146**, 440—446).—A comparison of the phosphorescent spectra of two specimens of fluorspar (chlorophane and a fluorspar from Titlis) shows that, whilst the two spectra have bands in common, these are not the most characteristic bands in either spectra, but the flame spectrum of fluorspar from any source is always the same. In view of these facts, the author is of opinion that the bands cannot be wholly attributed to the presence of rare earths as stated by Urbain (Abstr., 1907, ii, 3). The phosphorescent spectra of apatite and scheelite are almost identical, and it would appear, therefore, that neither the phosphorus in the one nor the tungsten in the other mineral plays any part in the phosphorescent phenomenon, which is due to the constituents common to the two minerals, namely, the calcium and the rare earths.

M. A. W.

Absorption Spectra of the Vapours of Benzene and its Homologues at Different Temperatures and Pressures, and also of Solutions of Benzene. W. NOEL HARTLEY (*Proc. Roy. Soc.*, 1908, **80**, *A*, 162—165. Compare Friederichs, Abstr., 1905, ii, 782).—Variations in the vapour-spectra of benzene at different temperatures and pressures are due to the fact that there are two kinds of absorption: (*a*) general absorption (due to encounters between the molecules), which is broadened and extended towards the less refrangible rays by rise of temperature; (*b*) selective absorption (due to atomic vibrations), which includes all the individual bands and groups of bands which are not widened or displaced by rise of temperature. The selective absorption can be studied most advantageously by raising the general absorption to a maximum (at 100°) and studying the spectra produced by reduction of pressure.

The bands of the benzene spectrum between 12·7° and 25° may be resolved into four spectra which partially overlap; two are composed of strong bands, of which there are 54 (27 in each spectrum), and the other two of about 30 weak bands. The intensities of the bands are much the same at 100° and at lower temperatures. The similar groups of bands in the spectra of benzene and its homologues show that the mode of vibration within the nucleus is not greatly affected by the side-chain substitution. The influence of the position of the substituted hydrogens on the number and position of the bands in the spectra of its homologues is clearly shown.

The relationships between vapour-spectra and solution-spectra are discussed. It is shown that up to nine bands may be recognised in the solution spectra of benzene, six of which are similarly constituted, and four of these are almost exactly similar in all respects. These four correspond with the four groups of vapour-bands already mentioned, and occur where these bands overlap to the greatest extent. The view of Baly and Collie (Trans., 1905, **87**, 1332) that benzene has seven and no more than seven solution-bands is shown to be incompatible with the facts. G. S.

Absorption Spectra of Collidine and Nonachlorocollidine. John E. Purvis and W. H. Foster (*Proc. Camb. Phil. Soc.*, 1908, **14**, 381—384).—The character of the absorption band of collidine is similar to that of pyridine (Hartley, Trans., 1885, **47**, 685) and of lutidine (Baker and Baly, Trans., 1907, **91**, 1122), except that it is moved a little more towards the red end of the spectrum. In the case of nonachlorocollidine, there is a much greater shift towards the red end, and also a slight decrease in the persistence of the band. From this the conclusion is drawn that the nine chlorine atoms have replaced the nine atoms of hydrogen in the methyl groups, and have not entered the nucleus. P. H.

Anomalous Magnetic Rotary Dispersion of Neodymium. Robert W. Wood (*Physikal. Zeitsch.*, 1908, **9**, 148—151).—In general, the magnetic rotation of the plane of polarisation is greater for short wave-lengths than for longer ones. For neodymium nitrate, however, the rotation is smallest in the blue, it increases gradually in the green, and then very rapidly as the absorption band in the yellow is approached. No marked increase or decrease on the red side of the band could be observed. The anomaly is thus the same as that observed at the *D* lines in sodium vapour. T. E.

Does Beer's Law Hold for Colloidal Solutions? Oscarre Scarpa (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, Supt. II, 50—52).—The dependence of the absorption of light on the concentration and the thickness of the solution has been examined in the case of colloidal solutions of platinum, silver, nickel, cobalt, and copper prepared by the electrical method. Deviations from Beer's law amounting to 10% were observed.

With increasing dilution, the absorption in the violet region diminishes in all cases, whereas in some cases the effect of dilution is to increase the absorption at the red end of the spectrum. Chemically-prepared colloidal solutions of ferric hydroxide, basic ferric acetate, arsenious sulphide and silver, obtained according to Schneider's method by reduction of silver nitrate, also exhibited deviations from the requirements of Beer's law, accompanied by increased absorption in the violet region as the dilution of the solutions was increased.

H. M. D.

The Reduction [of the Photographic Image] with Persulphate and according to Farmer. JOHANNES PINNOW (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 130—135).—The mode of action of ammonium persulphate as a photographic reducing [weakening] agent has been examined. The change of colour from black to a brownish-black, which is sometimes observed on treatment with ammonium persulphate, is evidence of the formation of a new solid substance. This is shown to contain sulphuric acid, and the author supposes that the substance is either silver sulphate or a compound of this with gelatin. The reducing action of persulphate is accelerated by silver salts, a fact which is utilised to explain the mode of action of the persulphate. Two different views are suggested. According to the first, reaction takes place between the finely-divided silver and the persulphate, as represented by the equations: $(NH_4)_2S_2O_8 + 2Ag = Ag_2SO_4 + (NH_4)_2SO_4$; $(NH_4)_2S_2O_8 + Ag_2SO_4 + 2H_2O = 2AgO + (NH_4)_2SO_4 + 2H_2SO_4$. The silver peroxide then reacts with a further quantity of silver and sulphuric acid to give silver sulphate, which decomposes further persulphate according to the second equation.

According to the second view, the small amounts of Caro's acid which are present in the persulphate are supposed to play a part. The liberation of ozone from Caro's acid takes place very rapidly in presence of silver salts which act catalytically. The formation of silver sulphate, according to the first equation, furnishes the requisite catalytic agent, and the ozone liberated reacts with silver to form peroxide, which, with the finely-divided silver and sulphuric acid, yields a further quantity of the sulphate, and thus the reaction progresses with gradually increasing velocity. The catalytic activity of the silver salts explains the difficulty of obtaining good results when ordinary tap-water is used in reducing by means of persulphate. The formation of silver salts must be prevented by using chlorine-free distilled water.

H. M. D.

What is Radium? The Composition of Metals Calculated and Established. R. FAUST (*Chem. Zentr.*, 1907, ii, 1963; from a pamphlet, *Dresden*, 1907, 1—15).—A theoretical paper, in which the conclusions of Ramsay (Trans., 1907, **91**, 1593) are criticised, and the suggestion put forward that the alkali metals are composed of a metal with radium emanation, the latter having a negative atomic weight (−88·5). An example given is $(\frac{1}{2}Cu)_4Ra = K = 39$.

J. V. E.

Phosphorescence Produced by Canal Rays. JOHN TROWBRIDGE (*Amer. J. Sci.*, 1908, **25**, 141—142).—When canal rays fall on lithium chloride, a red phosphorescence is produced, whereas cathode rays usually give a faint blue colour. The author shows that this difference is due to the greater energy contained in the canal rays, for a cathode stream, if sufficiently intense, induces the red phosphorescence. In order to obtain this result, the cathode stream is concentrated to a focus on the lithium chloride by passing it through the longitudinal magnetic field produced by a solenoid. R. J. C.

The Radioactivity of Sea-Water. JOHN JOLY (*Phil. Mag.*, 1908, [vi], **15**, 385—393. Compare Strutt, Abstr., 1906, ii, 716).—The author has measured the radioactivity of sea-water taken from different parts of the Atlantic and also from the Arabian Sea. The emanation was usually distilled off and estimated by the electroscopic method. It was found that trustworthy results could be obtained when the water was acidified with a few c.c. of purified hydrochloric acid per litre in order to liberate the emanation from suspended particles and to prevent the formation of a precipitate during boiling.

The average activity of four samples collected off the West of Ireland and one from the Isle of Man was equivalent to $0{\cdot}0344 \times 10^{-12}$ grams of radium per gram of water. A sample from the Arabian Sea gave $0{\cdot}0278 \times 10^{-12}$, and five samples collected between Madeira and the Bay of Biscay gave the value $0{\cdot}0172 \times 10^{-12}$ grams radium per gram, whereas Eve (*Phil. Mag.*, 1907, [vi], **13**, 248) obtained only $0{\cdot}0003 \times 10^{-12}$ grams of radium per gram of water from mid-Atlantic.

These figures point to an increase in radioactive material near the land. The author supposes that much of the radioactive matter reaches the sea in very fine suspension, and ultimately finds its way into the sediments everywhere collecting. R. J. C.

The Lithium in Radioactive Minerals. MLLE. ELLEN GLEDITSCH (*Compt. rend.*, 1908, **146**, 331—333).—In continuation of her investigation of radioactive minerals for the presence of copper and lithium (this vol., ii, 9), the author has estimated the copper (as cuprous sulphide) and the lithium (by spectroscopic comparison of the residues remaining after the elimination of all the other metals, except those of the alkalis, with artificial mixtures of sodium and lithium chloride) in some radioactive minerals, and has obtained the following results:

	Copper.	Lithium.	Radioactivity compared with uranium.
Joachimsthal pitchblende	1·2%	0·00017%	1·5
Colorado pitchblende	0·15%	0·00034%	1·75
Carnotite	0·15%	0·030%	0·52
Chalcolite (from Cornwall)	6·54%	0·00011%	2·0
Autunite	0	0·00083%	1·48
Thorite	trace	0·0033%	0·59

The gangue accompanying the chalcolite contained 0·012%, and that with the autunite, 0·0033%, of lithium. It is to be noted that carnotite contains much lithium with but little copper, whilst the reverse is the case in thorite. Autunite, like gummite (McCoy, *Nature*, Nov. 28th, 1907), contains lithium, but no copper. In the latter cases, the copper may have been transformed into lithium, but this is not very probable, since chalcolite contains so much copper and very little lithium. Owing to the sensitiveness of the spectroscopic reaction of lithium, it is difficult in some cases to determine whether this metal is present in the mineral itself or in the accompanying gangue. The results, whilst not invalidating Ramsay's theory (Trans., 1907, **91**, 1593), are not favourable to it; they prove that no simple relation exists between the copper and lithium in radioactive minerals. E. H.

Lithium in Radioactive Minerals. Sir William Ramsay and Alexander Cameron (*Compt. rend.*, 1908, **146**, 456—457).—The detection of lithium in certain radioactive minerals has not the exclusive significance attributed to it by McCoy (*Nature*, Nov. 28th, 1907) and by Mlle. Gleditsch (this vol., ii, 9, and preceding abstract). The authors have shown (Trans., 1907, **91**, 1593) that lithium is one of the products of the action of radium emanation on copper salts, but it is probable that other alkali metals are also produced, as the alkali residue obtained from the salt after treatment with radium emanation was greater than before, and a spectroscopic examination showed the presence of both sodium and potassium; experiments now in progress involving the use of silica vessels will decide whether the presence of these metals in the residue is due to the use of glass vessels.

The proportions of the degradation products appear to depend on conditions at present unknown, for, whilst helium is the ordinary degradation product of radium emanation, neon is formed in the presence of water, and argon in the presence of a copper salt.

M. A. W.

Scattering of β-Rays from Uranium by Matter. J. Arnold Crowther (*Proc. Roy. Soc.*, 1908, **80**, *A*, 186—206)—The scattering of the β-rays from uranium by matter has been investigated by comparing the intensity of a parallel pencil of the radiation traversing a fixed cross-section when a thin plate is interposed between the source and the cross-section at some distance from the latter with that in the absence of the plate. Very thin plates of mica, aluminium, copper, silver, and gold were used. As the source of the rays, uranium-X was employed.

β-Rays are completely scattered in a thickness of material much less than that required to absorb them; scattering is complete after they have traversed a thickness of material varying from 0·015 cm. for aluminium to 0·0002 cm. for gold. The scattering, after correcting for absorption, may be represented by an equation of the form $I/I_0 = e^{-\sigma d}$, where d is the thickness of material traversed, σ is the coefficient of scattering, and I_0 and I are the respective intensities of the radiation passing the cross-section referred to above, in the absence and presence of the thin plate.

The ratio of the coefficient of scattering to the coefficient of absorption (Abstr., 1906, ii, 720) is approximately constant for all the substances examined, its average value being about 13. G. S.

Presence of Thorium in the Soil at Rome. GIAN A. BLANC (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 101—106).—By collecting, on a negatively charged metallic wire, the whole of the thorium products A, B, and C resulting from the thorium emanation liberated from a definite area of the soil at Rome under normal conditions and determining the rate of discharge of a sensitive electroscope under the influence of the wire, the author finds that the soil contains a quantity of thorium capable of generating the same emanation as it would do if it contained 0·00166% of thorium hydroxide. If the thorium is present in the soil in a form other than hydroxide, the proportion of thorium compound must be considerably greater than that given above. T. H. P.

Wehnelt Cathode in High Vacuum. J. E LILIENFELD (*Physikal. Zeitsch.*, 1908, **9**, 193).—The author takes exception to the opinion of Soddy (this vol., ii, 81) that the Wehnelt cathode ceases to be active at very high degrees of exhaustion. The phenomena observed in highly exhausted discharge tubes are due to the large increase in the fall of potential of the positive column, which is independent of the nature of the electrodes, as the author has shown in experiments published previously. H. M. D.

Aluminium in the Potential Series. JOHANNES J. VAN LAAR (*Chem. Weekblad*, 1908, **5**, 124—127).—Polemical. A reply to van Deventer and van Lummel (this vol., ii, 12). A. J. W.

Electro-chemistry of Lead. ALEXANDER C. CUMMING (*Trans. Faraday Soc.*, 1907, **2**, 199—213).—The object of the research is to determine the affinity of the change $Pb^{\cdot\cdot\cdot\cdot} \rightleftarrows Pb^{\cdot\cdot} + 2F$, which (at 25°) is expressed in volts by $e = P + 0{\cdot}0591/n \log_{10}[Pb^{\cdot\cdot\cdot\cdot}]/[Pb^{\cdot\cdot}]$, where P is a constant which is characteristic of the reaction, and the bracketed quantities are the concentrations of the quadri- and bivalent lead ions in a solution. Suitable solutions were made by saturating nitric acid with lead peroxide. The solubility of lead peroxide in nitric acid (in milligram-molecules per litre) is $5{\cdot}3N$ acid, 0·104; $7{\cdot}5N$ acid, 0·415; $9{\cdot}2N$ acid, 0·8, and $11{\cdot}5N$ acid, 1·54. The effect of the concentration of the acid on the solubility is given by the expression $[Pb^{\cdot\cdot\cdot\cdot}]/[H^{\cdot}]^4[H_2O]^2 = \text{constant}$, and the values found agree with this; it is therefore probable that the lead dissolves as quadrivalent ions. The potentials of platinum electrodes coated with lead peroxide in nitric acid solutions of quadri- and bi-valent lead ions were measured against a calomel electrode, the diffusion potential being eliminated by means of a strong solution of ammonium nitrate. The mean value of P (referred to the hydrogen electrode) found is 1·83 volts, assuming in the calculation that the ionic concentrations vary in the same way as those of the total lead salts dissolved. Measurements of concentration cells containing lead electrodes in solutions of lead nitrate in nitric acid show that this assumption is not true for the bivalent ions, especially in the more concentrated acids.

The solubility of lead nitrate in nitric acid at 25° is found to be (gram-mols. per litre) in water, 1·62; in 2·02N acid, 0·536; in 4·64N acid, 0·185; in 8·77N acid, 0·042, and in 14·35N acid, 0·0017.

The effect on the ionisation of a 0·1 molar solution of lead nitrate of the addition of alkali nitrates was investigated by means of concentration cells. Equal quantities of sodium, potassium, and ammonium nitrates diminish the ionisation to very different extents. Lead nitrate is less soluble in nitric acid or sodium nitrate than it is in water, but more soluble in potassium nitrate, showing that complex ions are formed; hence no information about the dissociation in nitric acid can be obtained from experiments with alkali nitrates.

A few measurements of the concentration of plumbous ions in alkaline solution were made, and the solubility of lead monoxide in water was found to be $3·8 \times 10^{-6}$ gram-mols. per litre. T. E

Measurement of Electrode Potentials. WLADIMIR KISTIAKOWSKY (*Zeitsch. Elektrochem.*, 1908, **14**, 113—121).—The potential difference between a metal and a solution is affected by the quantity of oxygen dissolved in the latter. The author has observed as much as 0·2 volt difference between a copper electrode touching the surface of a solution of potassium cyanide and one dipping under the surface; hence it is better to eliminate oxygen by working in a closed apparatus. The effect of local galvanic actions between different parts of the electrode surface is avoided by polishing the surface and examining it microscopically for inequalities, and by rotating the electrode rapidly and measuring the *E.M.F.* during and after the rotation; the two measurements should give the same result. A number of examples are given in which electrodes of zinc and magnesium are used.

T. E.

Anomalous Anodic Polarisation by Nitric Acid. H. W. HUGO SCHELLHAASS (*Zeitsch. Elektrochem.*, 1908, **14**, 121—127).—The anode potential at a platinum anode and the yield of active oxygen are measured in mixtures of sulphuric and nitric acids. The anode potential is a maximum in a mixture of 70 mols. sulphuric acid and 30 mols. nitric acid of normal strength; in 4N acid the maximum is at 90 mols. H_2SO_4, and in 10N acid at about 98 mols. H_2SO_4. These results are true for a current density of 0·05 ampere per sq. cm.; at higher current densities the maximum is much closer to the sulphuric acid end of the curve. The quantity of oxygen fixed at the anode rises and falls with the anode potential. Even in pure nitric acid some oxygen is fixed, which may be due to the formation of a pernitric acid. T. E.

Thermodynamics of Cells with Solid Substances. RICHARD LORENZ and M. KATAYAMA (*Zeitsch. physikal. Chem.*, 1908, **62**, 119—128).—A theoretical supplement to Katayama's experimental work (this vol., ii, 145). It is shown that the Gibbs-Helmholtz formula is applicable to the cells which were investigated. J. C. P.

Alkali Double Salts of Cadmium Chloride. EUGEN VON BIRON and B. P. APHANASSIEFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 70—78).—With the view of determining whether the rôle of the alkali halides in the formation of double salts is merely the furnishing of halogen ions by their dissociation, concentration cells of the type Ag.AgCl | $N/1$MCl | sat.MCl | $N/1$MCdCl$_3$ | AgCl.Ag have been investigated (where M equals an alkali metal).

The concentration of Cl$'$ ions is the same for potassium and ammonium, since the degree of dissociation of potassium and ammonium chloride is the same at both concentrations, $N/1$ and $N/2$, but the lowering of concentration of Cl$'$, taking place partly owing to the formation of $CdCl_3'$, is greater for $KCdCl_3$ than for NH_4CdCl_3; it is thus evident that the elementary dissociation of the alkali salts is not the only cause of the formation of double salts in solution, the process being probably far more complex.

If $\delta_1\delta_2$ = lowering of concentration of Cl$'$ for solutions $N/1$MCl + $N/1$CdCl$_2$ and $N/1$MCl + $N/2$CdCl$_2$ respectively, then for potassium and ammonium $\delta_2 > \delta_1/_2$, but for lithium and sodium, which form most probably the salts M_2CdCl_4 or $M_3Cd_2Cl_7$, $\delta_2 < \delta_1/2$. Z. K.

Concentration Cells. II. EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 79—92. Compare this vol., ii, 145).—When working with cadmium electrodes, a white or grey deposit is always obtained, which, on examination, proves to be an oxychloride of cadmium mixed with a little metallic cadmium. The formation of this layer can only be avoided when the air is wholly removed from the reacting solution and vessel, but in that case there seems to occur a slight distillation of the cadmium, which appears as thin layers here and there on the surface of the cathode.

Experiments were made with electrodes which had been (1) untreated, (2) polished, (3) polished more thoroughly, with the following results. (*a*) Electrodes of equal surface display a greater difference when they have been variously treated than when they have undergone the same treatment. (*b*) In $N/1$ or more concentrated solutions, the more highly polished electrode always forms the + pole of the element. (*c*) With removal of air, the difference between the electrodes diminishes, but the more polished electrode becomes the cathode even in very dilute solutions. (*d*) The difference in potential diminishes with time, and the more rapidly the more thoroughly evacuated the solution. In any case, this difference is more marked for dilute than for concentrated solutions, and cannot be overcome even by vigorous stirring.

From these and other experiments in a specially constructed vacuum apparatus, the conclusion is drawn that cadmium forms good electrodes only in a vacuum, that the electrodes should always undergo the same treatment, and that all the anomalies observed by various investigators when working with cadmium electrodes are due to the formation of cadmium oxychloride by the interaction of the enclosed air and the cadmium chloride solution. Z. K.

A Silver Micro-voltameter. EMIL BOSE and F. CONRAT (*Zeitsch. Elektrochem.*, 1908, **14**, 86—88).—The silver nitrate solution is contained in a U-tube, one limb of which contains the anode, consisting of a small piece of silver fused to the end of a platinum wire, and the other limb the cathode. This is a piece of platinum wire 0·05 to

0·1 mm. diameter and 1·5 to 2·5 cm. long, which is hung on a platinum hook so that it dips into the solution about 1 cm. It is weighed on a Nernst micro-balance. The currents used varied from about 0·003 to 0·1 milliampere, and the quantities of silver deposited from 0·5 to 2 mg., the accuracy being 0·25 to 0·5%.

Experiments in which the electrolyte was a solution of silver nitrate, treated with excess of metallic silver at 95°, gave deposits about 2% heavier than those obtained from a cold solution with the same current. This result is attributed to the presence of $Ag_2^{\cdot}$ ions, which would also explain the irregularities of the silver voltameter. T. E.

Electrical Conductivity and Internal Friction. N. LEMCKE (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 1134—1138).—In order to determine whether the regularities regarding the internal friction of sodium chloride solutions were also applicable to other salts, glycerol and aqueous solutions of potassium chloride and bromide were examined by the method employed previously (Pissarjewsky and Lemcke, Abstr., 1905, ii, 684), with the following results: (1) the degree of dissociation of potassium chloride is greater in a mixture of glycerol and water than in pure water. (2) $k = \mu_x . \eta_x$ = about 151 both for potassium chloride and bromide, and is independent of the solvent. (3) As in the case of sodium chloride so with potassium chloride, the internal friction changes periodically with the increase in volume of the solvent. Z. K.

Electrical Conductivity in Mixtures of Acid or Base and Water. G. BOIZARD (*Ann. Chim. Phys.*, 1908, [viii], **13**, 289—361. Compare Abstr., 1906, ii, 419).—The paper commences with a résumé of the work done on this subject during the past twenty years. This is followed by a detailed description of the two methods of measurement employed; (1) Lippmann's (*Compt. rend.*, 1876, **83**), modified by Bouty (*Ann. Chim. Phys.*, 1884, [vi], **3**), and (2) Kohlrausch's, in which the solution and the solvent to be compared form two arms of the Wheatstone bridge, and by a discussion of their causes of error. The work described in the present paper relates only to sulphuric acid as a solvent and ammonium, sodium, potassium, and potassium hydrogen sulphates, acetic acid, and potassium acetate as solutes. The sulphuric acid is used in concentrations of 0·25%. 0·5%, 1%, 2%, 3%, 5%, 10%, 15%, 20%, 30%, 45%, 60%, 73%, 84·5%, 88%, 92%, 97·5%, and 100%. The ratios (l) of the differences between the conductivities of solutions of the above salts at varying concentrations in these solvents and the conductivities of the solvents, compared with the latter are given in tabular form, and also plotted against the concentrations in gram-molecules per litre (m) of solution, in the form of curves. The latter are shown to be of five distinct types. The results show that for all the above salts there are two concentrations of sulphuric acid, one very high and the other very low, between which addition of the salt lowers the conductivity of the acid. At concentrations of sulphuric acid above the higher and below the lesser of these limits, addition of solute has the normal effect of increasing the conductivity. The curves show that in 0·25%, 0·5%, and 1% acids, Bouty's law (compare Abstr., 1884, 881, 1241; 1886, 653, 839; 1887, 758, 877, 882) holds for ammonium and potassium sulphates at concentrations up to half a gram-molecule per litre, and, if allowance is made for the water set free by secondary changes of other salts, the conclusion is drawn that the law holds generally for sulphuric acid as a solvent, considering always the acid of minimum conductivity. In many cases, it is observed that the solutions in acid are better conductors than the aqueous solutions of the same salts, showing that sulphuric acid is a more highly dissociating solvent than water. The conductivity of 20% acid is not altered by addition of potassium hydrogen sulphate at concentrations up to a half gram-molecule per litre; the same phenomenon is observed with the sodium salt in 15% acid. In acids of concentrations from 20 to 90%, the molecular variation of the conductivity of ammonium sulphate remains constant at concentrations up to 1 gram-molecule per litre. Determinations of the solubility of this salt in sulphuric acid of varying strengths show that 60% acid has the least dissolving power. Similarly, sodium and potassium sulphate have a minimum solubility in 60% acid The ratio l varies slightly with the temperature according to the equation $l_t = l_{18}[1 + k(t - 18)]$, k being positive or negative, and generally independent of the concentration. A table of the observed values of k for different salts is given.

In the case of solutions, which according to their concentration are at first less and then more highly conducting than the solvent, in the neighbourhood of the concentration of equal conductivity, the temperature effect is to change the sign of the variation of conductivity. But at very high or very low concentrations, rise in temperature produces an increase in the variation. In the case of the acid sulphates and acetic acid, k is negative for all the solvents studied. At high temperatures, the temperature effect for ammonium sulphate tends towards zero.

The author finds that an acid more nearly 100% than that indicated either by Kohlrausch (Abstr., 1883, 413, 769) or by Knietsch has the minimum conductivity $70{\cdot}6 \times 10^{-4}$, instead of the value 80×10^{-4} given by Kohlrausch. E. H.

Electrolysis of Solutions of Pure Hydrogen Chloride. EMMANUEL DOUMER (*Compt. rend.*, 1908, **146**, 329—331).—During the electrolysis of hydrochloric acid, pure hydrogen is collected at the cathode, but the chlorine collected simultaneously at the anode is never pure, being always mixed with varying quantities of oxygen. The volume of oxygen evolved varies with the strength of the solution, increasing considerably as the concentration of hydrogen chloride diminishes. In a series of experiments in which solutions of hydrogen chloride, containing 14·5—0·72 grams per litre, were electrolysed between platinum wires 0·5 mm. thick and 6 cm. long by currents of about the same intensity in each case, the ratio (v/V) of the volume of oxygen (v) to that of the hydrogen (V) evolved, increased from 0·034 to 0·212. To determine whether the oxygen is formed by the action of the nascent chlorine on the water, or from actual electrolysis of the water, an experiment was made, using a silver anode to combine with the chlorine set free. In this case, a larger volume of oxygen was produced, from which it is deduced that the latter explanation is correct. The deficit of oxygen with the platinum anode is probably due to the formation of oxides of chlorine. If all the oxygen evolved could be measured, the ratio of the number of ions produced from the water to the total number of ions could be determined. The conclusion is drawn that, in the electrolysis of hydrochloric acid, part of the current is used in decomposing the water, and it is therefore necessary to take this into account when determining the transport numbers of $\overset{+}{H}$ and $\overset{-}{Cl}$, or the conductivity of hydrogen chloride solutions. E. H.

Strong Electrolytes. Alexander C. Cumming (*Trans. Faraday Soc.*, 1907, 2, 213—221).—In order to eliminate the potential difference at the contact of two dissimilar solutions, a strong solution of potassium chloride has been interposed between the solutions. The author studies the effect of solutions of potassium and ammonium nitrates. A 10*N* solution of the latter salt completely eliminates the diffusion potential between solutions of hydrochloric acid and of lithium chloride. A saturated solution of potassium nitrate is not sufficiently concentrated to do so. Solutions of salts the ions of which have very different mobilities are quiet ineffective, as the theory requires.

The above result was applied to the measurement of the *E.M.F.*'s of cells containing silver electrodes in solutions of silver nitrate directly connected or separated by a 10*N* solution of ammonium nitrate. Using *N*/10 and *N*/100 silver nitrate directly connected, the *E.M.F.* is 0·0590 volt, whilst when connected through ammonium nitrate it is 0·0556; the difference between these numbers is the eliminated diffusion potential, which is calculated from Nernst's formula to be 0·0033 volt, in close agreement with the experimental result. The *E.M.F.* of the concentration cell, apart from the diffusion potential, may be calculated from the ratio of the concentrations of the silver ions in the two solutions; taking the conductivities as a measure of these concentrations, the *E.M.F.* comes out at 0·0557 volt. In a similar way, the author finds for 0·01*N* and 0·001*N* solutions the *E.M.F.* to be 0·0579 volt (0·0580 calculated), and for 0·1*N* and 0·5*N* solutions 0·029 volt (0·0292 calculated). He considers that conductivity is a true measure of ionisation. T. E.

Decomposition Curves of Lithium Chloride in Pyridine and in Acetone. The Effect of Water. Harrison E. Patten and William R. Mott (*J. Physical Chem.*, 1908, 12, 49—74. Compare Abstr., 1904, ii, 379).—Lithium can be deposited on a smooth platinum cathode at 25° from an anhydrous saturated solution of its chloride in pyridine or in acetone at a current density of 0·001 amp./cm². The cathode polarisation due to deposited lithium is + 2·60 volts both in pyridine and in acetone, as compared with about 2·45 volts for water ("absolute" potentials according to Ostwald), although the heats of solution of the chloride in the respective solvents are very different, being equivalent to 0·254, 0·371, and 0·613 volt in acetone, water, and pyridine respectively. The total polarisation of the cell is about 4 volts in pyridine and 4·15 volts in acetone.

When a little water is added to the solution of lithium chloride in pyridine, the current rapidly diminishes almost to zero, owing to the formation of an insulating film on the cathode.

The effect on the conductivity of the gradual addition of water and lithium chloride respectively to pyridine has been determined. For solutions containing more than 0·5% of lithium chloride, the increase of specific conductivity with further increase in the proportion of salt is very slow. The conductivity of a pyridine solution of lithium chloride is greatly increased at first by adding a little water, 0·5% of the latter doubling the conductivity of a $N/3$ solution of the chloride; the effect of adding water to the acetone solution is much less.

The current efficiency (estimated by measuring the gas liberated at the cathode) for the deposition of lithium from a pyridine solution at a current density of 0·1 amp./cm.^{2} is 23·3%; from an acetone solution at a current density of 0·001 amp./cm.^{2}, 38·5%, and from an amyl alcohol solution at a current density of 0·0012 amp./cm.^{2}, 44·8%. G. S.

Validity of Faraday's Law in the Electrolysis of Hot Porcelain. Fritz Haber [with A. Rieff and P. Vogt] (*Zeitsch. anorg. Chem.*, 1908, **57**, 154—173. Compare Abstr., 1907, ii, 6, 66 67).—As electrolyte, unglazed porcelain (a Rose's crucible) was used. The current was conveyed by graphite rods dipping in melted tin, the latter making contact both outside and inside with the crucible, the tin inside the crucible forming the cathode. The *E.M.F.* was so adjusted that 3—4·5 milliamperes per sq. cm. passed from the anode to the cathode tin through the crucible at the lower temperatures, and the current was measured with a silver voltameter. The whole arrangement was kept at an approximately constant temperature (at intervals between 800° and 1250°) in an electric furnace, access of oxygen to the cathode compartment being carefully prevented. After the electrolysis, the amounts of different metals which had passed into the cathode tin were determined by analysis. Porcelain is a conductor from 300° upwards.

The cathode compartment was found to contain aluminium (very little at lower temperatures), iron, calcium, magnesium, potassium, and sodium. There is reason to suppose that the conductivity at the lower temperatures is mainly due to alkalis, and that aluminium silicate, the chief constituent of porcelain, becomes to some extent a conductor at higher temperatures. On this view, the relatively large proportions of magnesium and calcium in the cathode liquid are a little surprising, and some evidence has been obtained that the liberated alkali metals react in a secondary manner with the porcelain, liberating magnesium and calcium. The results were checked by analysis of the porcelain before and after electrolysis.

Comparison of the quantity of electricity which passes with the amounts of the different metals liberated in the electrolysis show that, within the limits of experimental error (which is naturally somewhat large), Faraday's law is valid for porcelain as electrolyte.

G. S.

Thermo-electric Power of Lithium and Sodium. Arciero Bernini (*Nuovo Cim.*, 1908, [v], **15**, 29—42. Compare Matthiessen, *Ann. Phys. Chem.*, 1858, **103**; Naccari and Bellati, *Nuovo Cim.*, 1876).—The author has investigated the thermo-electric properties of lithium and sodium at various temperatures, lead being used as the second metal of the couples used.

In the case of lithium, the constants b and c of Avenarius's formula $e=(t_1-t)[b+c(t_1+t)]$ are found to have the mean values 0·00001281 and 0·00000001905 respectively for the temperature interval 10—173°. The temperature of inversion, given by the quotient $-b/c$, is $-674·2°$, and the neutral point $-332·1°$. These results, which were obtained by means of a Latimer Clark potentiometer, were very nearly confirmed by measurements made with a Dolezalek electrometer.

Sodium differs from lithium in being negatively thermo-electric towards lead. The values of b and c for sodium are 0·000004339 and 0·0000000113 respectively, these holding, with close approximation, up to temperatures higher than the melting point of sodium; the neutral point is here $-192°$. Naccari and Bellati (*loc. cit.*) were led to the conclusion that, in the neighbourhood of the melting point of sodium, the course of the curve connecting the *E.M.F.* of the sodium–lead couple with the temperature cannot be well represented by a parabola of the second degree, but the author finds no such irregularity.

Taking the thermo-electric power P as being $b+2ct_1$ and $\theta=273+t$, the following equations are obtained: $P=1·26+0·04\theta$ for lithium, and $P=-1·63+0·028\theta$ for sodium, the results being in microvolts.

T. H. P.

Quantitative Investigations on the Electrical Synthesis of Colloids. II. The Svedberg (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, Supt. II, 39—44).—The influence of changes in the arrangement of the electrical circuit on the production of a colloidal solution of cadmium in ethyl ether has been studied. The extent to which the electrodes are disintegrated and the medium decomposed is the same whether the induction coil is connected directly with the condenser or with the electrodes. The yield of colloid is unchanged whether a mercury or a Wehnelt alternator is used. By altering the constants of the discharge circuit within wide limits, the effect of varying the unsymmetrical distribution of potential was studied, and under all conditions the loss of weight of the two electrodes was found to be the same.

H. M. D.

Relation between the Ignition Temperature and the Vapour Pressure of Inflammable Liquids of Low Boiling Point. K. W. Charitschkoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 138—140).—Various fractions of naphtha and of light petroleum have been investigated, and the close dependence of the ignition temperature on the boiling point and vapour pressure of the substance is shown in tabular form.

Z. K.

Modified Bomb Calorimeter. Étienne Rengade (*Bull. Soc. chim.*, 1908, [iv], **3**, 188—190).—A modified form of Mahler's bomb calorimeter is described and figured, which is suitable for investigating the heat relations of such actions as the solution of the alkali metals in water.

The wiring arrangement for electric firing of the bomb is done away with, and is replaced by a steel piston passing through a pressure-stopper in the cover of the bomb and terminating (1) outside, in a pulley by means of which the bomb can be rotated in alternate directions, and (2) inside, in a disc, which can be used to break a fragile vessel containing a weighed quantity of the alkali metal. A stoppered outlet in the cover of the bomb is provided for the escape of gases at the end of the operation. A glass rod is placed diagonally inside, so that when the bomb is rotated the liquid is mechanically stirred by the rod. The precautions necessary in using the bomb and the corrections, which must be applied to results obtained by its use, are given. T. A. H.

The Neutral Alkali and Alkali-earth Carbonates. ROBERT DE FORCRAND (*Compt. rend.*, 1908, **146**, 511—515).—The whole of the thermochemical data necessary for comparison with experiments on the decomposition by heat of the alkali and alkali-earth carbonates has not hitherto been known. The thermochemical cycles concerned are: M_2O(solid) + CO_2(gas) = M_2CO_3(solid) + x; M_2CO_3(solid) + Aq = A; M_2O(solid) + Aq = B; CO_2(gas) + Aq = 5·60 Cal.; M_2O(diss.) + CO_2(diss.) = M_2CO_3(diss.) + C (in all of which M_2 represents two atoms of an alkali, or one atom of an alkali-earth metal). The values of A for sodium and potassium carbonates, of B for lime, and of C for sodium, potassium, calcium, strontium, and barium oxides have long been known. The values of A for calcium, strontium, and barium carbonates are zero; for lithium, rubidium, and cæsium carbonates at 15°, the author finds +3·06, +8·75, and +11·84 Cal. respectively. Rengade (Abstr., 1907, ii, 737; this vol., ii, 155) has determined the heats of dissolution (B) of sodium, potassium, rubidium, and cæsium oxides; for lithium, strontium, and barium oxides, the author has obtained the values +31·2, +30·8, and +35·64 Cal. respectively, whilst for the heats of neutralisation (by dissolved carbon dioxide) of lithia, rubidium, and cæsia, he finds the values +20·57, +20·57, and +20·49 Cal. From these data are calculated the heats of combination of the solid oxides with gaseous carbon dioxide: (Na_2O,CO_2) + 76·88 Cal., (K_2O,CO_2) + 94·26 Cal., (Rb_2O,CO_2) + 97·42 Cal., (Cs_2O,CO_2) + 97·53 Cal., (CaO,CO_2) + 43·3 Cal. (amorphous) + 42·0 Cal. (calc. spar.) + 42·6 Cal. (aragonite), (Li_2O,CO_2) + 54·23 Cal., (SrO,CO_2) + 57·3 Cal. (orthorhombic), (BaO,CO_2) + 63·44 Cal. The first numbers in the series are not in accordance with Lebeau's results (Abstr., 1903, ii, 477; 1904, ii, 121), according to which cæsium carbonate would be more easily dissociated than rubidium carbonate, and the latter more so than potassium carbonate. From the author's general relation $Q/T \doteq 30$, the temperatures of dissociation are calculated to be calcium carbonate (aragonite) + 1160°, lithium carbonate, 1535°, strontium carbonate (orthorhombic), 1637°, and barium carbonate, 1842°, although the relation is not rigorously applicable, since the carbonates fuse below these temperatures. Experimentally, it is known that lithium carbonate loses all its carbon dioxide at 800°

in a current of hydrogen ; Zavrieff (Abstr., 1907, ii, 768) has found the temperature 910° for the dissociation of calcium carbonate, and Herzfeld and Stiepel have found 1250° for strontium carbonate and 1450° (approx.) for barium carbonate. The author considers that the discrepancies between the calculated temperatures are explained by a decrease in the heats of formation of the carbonates at high temperatures. In support of this, a concordant series of numbers having the mean $+34 \cdot 76$ Cal. is calculated by application of Clapeyron's formula to Zavrieff's curve between 800° and 900°. With this value for calcium carbonate, and values for lithium, strontium, and barium carbonates, obtained by applying similar reductions to those at the ordinary temperature, the temperatures 886°, 1200°, 1284°, and 1450° are obtained for the dissociation of the several carbonates. These (except that for lithium carbonate) agree with the observed values. E. H.

Heat of Formation of Antimony Hydride. ALFRED STOCK and FRANZ WREDE (*Ber.*, 1908, **41**, 540—543).—The earlier determinations of Berthelot and Petit (Abstr., 1889, 666) by decomposing antimony hydride by bromine according to the equation $SbH_3 + 4Br_2 = SbBr_5 + 3HBr$ cannot be accurate. The gas used contained only a small percentage of the hydride, and the greater portion of the antimony existed as tribromide, so that, in addition to the large amount of gas required, the method involved the knowledge of the heats of formation of hydrogen bromide and antimony tri- and pentabromides, as well as the heat of solution of bromine in potassium bromide. A simpler method was therefore desirable, and this was carried out by decomposing antimony hydride quantitatively into its elements by the electric spark in a stout cylindrical glass vessel of 300 c.c. capacity provided with a capillary tube, in which a small bulb was blown, fitted with platinum wires, and closed with a glass rod. At the other end of the cylinder a bent capillary tube was fused for the admission of the gas. The quantity of gas introduced was 0·8 gram, and a correction was made for the departure from the gas laws (compare Abstr., 1907, ii, 180). The calorimeter contained 4 litres of water, and the temperature was measured by a platinum resistance thermometer. The mean of three determinations gave $Sb(\text{metal}) + 3H = SbH_3$ $-33 \cdot 98$ Cal. at constant pressure and $-34 \cdot 27$ Cal. at constant volume. The earlier determinations gave $-86 \cdot 8$ Cal., and a comparison of Berthelot's determinations of the heats of formation of the hydrides of phosphorus and arsenic with that of antimony renders their re-investigation a necessity. W. R.

Heat of Vaporisation of Propionic Acid. A. FAUCON (*Compt. rend.*, 1908, **146**, 470—473).—Preliminary to the determination of the heat of vaporisation of propionic acid by Berthelot's method, the author has redetermined the corresponding constant in the cases of benzene and formic and acetic acids, with the following results : For benzene, $L = 93 \cdot 62$ Cal. [Schiff found 93·40 Cal. (Abstr., 1887, 9); Luginin, 92·97 Cal. (Abstr., 1899, ii, 269); Miss Marshall, 94·4 Cal. (Abstr., 1896, ii, 349)]; for formic acid, $L = 121 \cdot 03$ Cal. [Favre and

Silbermann, 120·7 Cal.; Miss Marshall, 120·36 Cal. (Abstr., 1896, ii, 589); Raoult, 120·9 Cal.]; and for acetic acid, $L = 97·37$ Cal. [Miss Marshall found 97 Cal. (Abstr., 1896, ii, 349); Raoult, 97·4 Cal.; Favre and Silbermann, 101·9 Cal., and Berthelot, 120·8 Cal.]. The propionic acid employed was purified by repeated crystallisations, and had b. p. 139·8°/761·2 mm. and m. p. $-19·3°$; the value of df/dt, using Schiff's number, 0·536, for the specific heat (*loc. cit.*), was found to be 23·61 mm., and the heat of vaporisation 90·43 Cal. In common with acetic and formic acids, propionic acid does not obey Trouton's law, the value of MS/T being 16·20 instead of 20·21. M. A. W.

Application of Low Temperatures to Some Chemical Problems: (1) Use of Charcoal in Vapour Density Determinations; (2) Rotatory Power of Organic Substances. SIR JAMES DEWAR and HUMPHREY O. JONES (*Proc. Roy. Soc.*, 1908, **80**, *A*, 229—238).—Barkla and Sadler (Abstr., 1907, ii, 731), on the basis of certain experiments depending on the use of Röntgen rays, have recently suggested that the accepted atomic weight of nickel is much too low. To test this point, the authors have redetermined the density of nickel carbonyl at 0° and low pressures by a method depending on the use of low temperatures and condensation with charcoal.

A vessel, measuring over two litres and surrounded by melting ice, was connected to a manometer and to an absorption tube containing charcoal, which could be detached and weighed. The apparatus was first exhausted by a Fleuss pump, and finally by subsidiary tubes containing charcoal and immersed in liquid air; the vessel was then filled with nickel carbonyl at a definite pressure, and, after equilibrium was attained, the carbonyl was absorbed in the tube for that purpose, immersed in liquid air, the tube being finally removed and weighed. It is shown that the method is fairly accurate.

The density of nickel carbonyl at 0° and 16—47 mm. pressure is 84·67—84·79, in satisfactory accordance with the accepted atomic weight.

The optical rotatory power of certain organic compounds, dissolved in alcohol and in light petroleum, has been measured at very low temperatures in a jacketed metal polarimeter with ends of thick glass, the cooling agent being poured into the space between the tube proper and the outer jacket.

The negative rotation of nicotine in alcohol diminishes regularly with temperature down to $-120°$, just as it does at temperatures above 0°, and that of bitter orange oil increases regularly down to $-95°$, also in accordance with its behaviour at higher temperatures. In both cases, the curve showing the relation between rotation and temperature is approximately a straight line, and extrapolation indicates that the rotation in both cases would be considerable at the absolute zero. G. S.

Anomalous Viscosity at the Clearing Point of so-called Crystalline Liquids. EMIL BOSE and F. CONRAT (*Physikal. Zeitsch.*, 1908, **9**, 169—173).—The viscosity of anisaldazine is measured between 170° and 190°. The sample used changed from a turbid to a clear liquid at 182·8°. The viscosity of the turbid liquid diminishes as the temperature rises up to 180°; it then begins to increase rapidly, reaching a maximum at the clearing temperature; above this temperature the viscosity of the clear liquid diminishes again in the usual way. The change of viscosity in passing from the turbid to the clear liquid is thus not isothermal, but is spread over an interval of two to three degrees. T. E.

Conductivity and Viscosity of Solutions of Certain Salts in Water, Methyl Alcohol, Ethyl Alcohol, Acetone, and Binary Mixtures of these Solvents. VII. Harry C. Jones and W. R. Veazey (*Zeitsch. physikal. Chem.*, 1908, **61**, 641—697).—The conductivity of cupric chloride in water, methyl alcohol, ethyl alcohol, and in binary mixtures of these solvents has been determined, as also the conductivity of potassium thiocyanate in all the four solvents mentioned in the title and their binary mixtures. The viscosities of these solvents, of their mixtures, and of the potassium thiocyanate solutions have been measured.

In some cases, a minimum of conductivity has been observed; even where a real minimum does not occur, the values found for the conductivity in the mixed solvent are in many cases considerably below the values calculated by the mixture rule. To these cases of virtual minima, as well as to the cases of actual minima, the theory of Jones and Lindsay (see Abstr., 1902, ii, 55; also Jones and Murray, Abstr., 1902, ii, 637; Jones and Veazey, Abstr., 1907, ii, 438) is applied.

A conductivity maximum has been observed for solutions of potassium thiocyanate in mixtures of acetone with methyl and ethyl alcohols, and it is shown that the fluidity also of the mixed solvent is at a maximum at the same composition. The explanation of such conductivity maxima adopted by Jones and Bingham (Abstr., 1906, ii, 66) is extended, and the phenomenon is referred ultimately to an aggregation of the two kinds of solvent molecules.

Whereas the conductivity of cupric chloride is greater than that of potassium thiocyanate at a corresponding concentration in water, the reverse is the case when the solvent is methyl alcohol, ethyl alcohol, or acetone. It is suggested that ternary electrolytes, although yielding three ions in water, dissociate into only two ions in organic solvents.

The temperature-coefficient of conductivity is found to be greatest for those mixtures of water and organic solvent which contain 25% of the latter. It is accordingly supposed that in these mixtures more complex aggregates between the solute and solvent are formed than in any other mixture of the same two liquids.

The conductivity of potassium thiocyanate is higher in acetone than in water; this is shown to be due to the greater fluidity of acetone, and the consequent higher speed of the ions; further, as shown by the difference between the temperature-coefficients of conductivity in the two solvents, the aggregates present in the water solution are much more complex than those in the acetone solution. J. C. P.

Conductivity and Viscosity of Tetraethylammonium Iodide in Water, Methyl Alcohol, Ethyl Alcohol, Nitrobenzene, and Binary Mixtures of these Solvents. VIII. HARRY C. JONES and W. R. VEAZEY (*Zeitsch. physikal. Chem.*, 1908, **62**, 44—58. Compare preceding abstract).—The conductivity of tetraethylammonium iodide in water and methyl alcohol exhibits a minimum for the 50% mixture both at 0° and 25°. A minimum conductivity, not so well marked, is observed also in water and ethyl alcohol. In mixtures of the two alcohols, and in mixtures of nitrobenzene and methyl alcohol, no minimum conductivity is observed, only a slight falling below the values calculated by the mixture rule. Both at 0° and 25°, the conductivity of tetraethylammonium iodide in mixtures of ethyl alcohol and nitrobenzene exhibits a slightly marked maximum, noticeable for all dilutions. A mixture of these two solvents, containing 25% of nitrobenzene, has, both at 0° and 25°, a greater fluidity than either of the constituents.

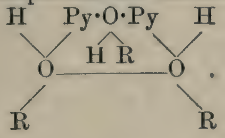
The various observations recorded in this paper are interpreted on the lines already described (*loc. cit.*).

In connexion with viscosity, the authors consider that the very marked influence of slight impurities accounts for the different values found by various observers for the viscosity of a given liquid. J. C. P.

Viscosities of Binary Mixtures of Organic Compounds. Formation of Molecular Compounds in the Liquid State. I. Mixtures of (*a*) Acetone and Chloroform, and (*b*) *m*-Cresol with (1) Aniline and (2) *o*-Toluidine. II. Mixtures of Pyridine with (1) Acetic Acid and (2) Butyric Acid. D. E. TSAKALOTOS (*Bull. Soc. chim.*, 1908, [iv], **3**, 234—242, 242—247).—The previous work of Poiseuille (*Ann. Chim. Phys.*, 1843, 50; 1847, 76), Graham (*Phil. Trans.*, 1861, 373), Thorpe and Rodger (Trans., 1897, 71, 360), Varenne and Godefroy (Abstr., 1904, i, 2), and Dunstan (Trans., 1907, **91**, 83, 1728) has shown that viscosity curves of liquid binary mixtures may be (1) *normal* (equal or only slightly below those calculated from the viscosities of the two components), (2) *negative* [much below the calculated, due according to Dunstan (*loc. cit.*) to breaking down of associated molecules of the components], (3) *positive* (much above the calculated) and showing one or more maxima, probably corresponding with the formation of molecular compounds. The object of the present investigation is to use viscosity determinations as a method of investigating the formation of such molecular compounds between liquids.

All the mixtures studied gave positive curves. The figures quoted are molecular concentrations per cent. For the two systems *m*-cresol and aniline and *m*-cresol and *o*-toluidine (at 25°), a maximum occurs at *m*-cresol, 65, and not 50 as might be expected. The deviation is probably due to partial decomposition of the molecular compound in each case. With chloroform and acetone, the curve for "time of flow" at 0° shows a maximum at chloroform, 50, but the maxima of the viscosity curves at 0, 20, and 40 for this mixture are displaced beyond that point. The viscosity curves of mixtures of (1) pyridine and acetic acid and (2) pyridine and butyric acid show well-marked maxima at acetic acid, 77·9, and butyric acid, 74·4, respectively.

The conclusion is drawn that in the first three mixtures, the compounds formed contain 1 mol. of each component, and in the last two, 2 mols. of pyridine combined with 3 mols. of the acid. The acetone-chloroform compound may have the constitution $CMe_2\dot{:}O\dot{:}CHCl_3$, and the pyridine-fatty acid compounds the constitution



T. A. H.

Simple Apparatus for Demonstrating the Dissociation Pressure of Solid and Liquid Substances. JAN VON ZAWIDZKI (*Chem. Zeit.*, 1908, **32**, 186—187).—A glass tube, 15—18 cm. long and 10 mm. external diameter, closed at one end, is filled to about 1/8 to 1/4 of its length with a substance which readily dissociates, such as $2AgCl,3NH_3$, $CaCl_2,4NH_3$, or $ZnCl_2,4NH_3$; a plug of glass wool is then inserted, and the open end drawn out and fused on to a capillary tube, *b*, 60—70 cm. long and about 2 mm. internal diameter. By means of a very fine, thin-walled capillary tube, a thread of mercury about 1 cm. long is introduced into the capillary tube *b* some 10 cm. from the junction with the large tube, after which the end of the tube *b* is sealed off. The length of the tube between the mercury and the sealed end is divided into divisions, representing pressures of 1, 2, 3, 4, &c., atmospheres in the large tube, by means of small indiarubber rings.

By preparing several tubes containing varying quantities of the same or different substances, it is possible by placing the tubes in an oil-bath to show that the pressure is (1) independent of the quantity of substance taken, and (2) varies with different substances.

W. H. G.

Adsorption Compounds. GUNNER JÖRGENSEN (*Zeitsch. anorg. Chem.*, 1908, **57**, 353—358. Compare Abstr., 1902, ii, 26).—The absorptive power of metastannic acid for nitric acid has been investigated by extraction of mixtures of the two acids with successive quantities of water for three or four months at room temperature and at 36°, the removal of the nitric acid been then practically complete. The ratios of the distribution of the nitric acid between the water and metastannic acid are tabulated. Similar experiments have been made with hydrochloric acid. G. S.

Fibre-like Developed Alumina (Fibre-alumina) and its Surface Actions (Adsorption). HANS WISLICENUS (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, Supt. II, 11—20.—In contact with mercury and moist air, aluminium oxidises with the formation of aluminium hydroxide of fibrous character. This resembles in many respects the natural fibres of plants and animals. It is doubly refracting, and, when examined through a plate of gypsum, it shows exactly the same colour distribution as the eccentric portion of a starch granule. The cause of the double refracting power is to be found in the lamellar structure; the double refraction disappears when the aluminium hydroxide is immersed in water or in xylene. The micro-structure and the optical properties remain unchanged when the hydroxide is converted into oxide by heating.

The fibrous aluminium hydroxide has very strongly developed adsorptive properties. The adsorptive power apparently increases when the hydroxide is converted into oxide, but, if equal molecular quantities are compared, the adsorptive powers are about the same. The adsorptive properties have been studied in detail by experiments with aqueous solutions of a large number of different substances, and comparative measurements have also been made on tannin solutions with other adsorbing materials. From these, it is evident that the adsorptive power of fibrous alumina is approximately equal to that of hide powder, and is much greater than that of other adsorbents, such as kieselguhr, meerschaum, and animal, bone, and wood charcoal.

The removal of substances from solution is shown to be due chiefly to surface action, and not to the formation of chemical compounds; in general, the quantities taken up from concentrated solutions are relatively smaller than the quantities removed from dilute solutions of the adsorbed substance.

An apparatus is described for "adsorption analysis," in which fibrous alumina is used as the active adsorbing material. This may be applied in the examination of all kinds of colloidal extracts, including tannin-, plant-, colour-, and drug-extracts. H. M. D.

Changes in Tanning [Processes]. Reginald O. Herzog and J. Adler (*Zeitsch. Chem. Ind. Kolloide*, 1908, 2, Supt. II, 3—11).—The adsorption of various substances from aqueous solution by lightly chromated hide powder has been investigated. The experiments were made at 25°, 5 grams of hide powder being shaken up with 100 c.c. of the solution for four hours, when the adsorption was found to be complete.

Phenol, catechol, resorcinol, and pyrogallol solutions of various concentrations were used, and for comparison the adsorption of the two first substances by animal charcoal was examined.

The experimental data are discussed in reference to the equation $c = K.a^m$, in which c denotes the concentration of the aqueous solution, a the quantity of substance adsorbed by the hide powder, and K and m are constants. When $\log a$ is plotted as a junction of $\log c$, the experimental data should be represented by a straight line if the above equation is satisfied. This is the case for the adsorption of phenol and catechol by animal charcoal, and of resorcinol and pyrogallol by hide powder, but the data for phenol and catechol adsorbed by hide powder correspond with curves which are convex to the $\log c$ axis.

A study of the influence exerted by mineral substances in $N/10$ solutions on the adsorption of phenol has shown that this is diminished by hydrochloric acid and still more by potassium hydroxide. A smaller, but similar, effect is produced by ammonium chloride, whereas salts of the alkaline-earth metals are without influence, and salts of the alkali metals slightly increase the adsorption.

Measurements of the adsorption of a number of acids, mineral salts, sugars, carbamide, acetone, colloidal substances, and colouring matters are also recorded. In general, the adsorption cannot be at all accurately represented by the equation $c = K.a^m$.

Attempts were made to measure the rate of adsorption of phenol, but the process was found to be too rapid both at 25° and at 0°. The fact, that the adsorption from a $0·025N$ phenol solution was the same as that from a $0·05N$ solution after the hide powder in the second case had been treated with an equal volume of water, is considered to be evidence in favour of a reversible process in the adsorption phenomena. H. M. D.

Time-law of the Capillary Rise of Liquids and the Relationship of Velocity to the Chemical Constitution. WOLFGANG OSTWALD and F. GOPPELSROEDER (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, Supt. II, 20—39).—The author finds that the experimental data obtained by F. Goppelsroeder (*Verh. der Naturforsch. Ges. Basel*, 1907, 19) in his investigations of the rate of rise of liquids in filter paper can be represented by the exponential equation $s = K.t^m$, in which s denotes the distance through which the liquid rises in time, t, and K and m are constants depending on the nature of the liquid, the fibrous character of the filter paper, the temperature, and other factors which in comparative experiments may readily be kept constant. The constant K varies from 2·21 to 15·10, and m from 0·04 to 0·49.

The view is put forward that the rate of rise of a liquid is determined by the magnitude of the capillary forces and the viscosity of the liquid. The fact that the values of the maximum capillary rise of different liquids in filter paper are not all proportional to the values obtained in glass tubes, is attributed to differences in the "wetting power" of the various liquids for filter paper, on the one hand, and glass, on the other. In the comparable series of monohydric fatty alcohols, the velocity constants, K, are shown to be related to the viscosity values. Examples of stoicheiometric relationships between the values of m and the chemical nature of the various liquids are also quoted. H. M. D.

The Crystalline State as a General Property of Matter. P. P. VON WEIMARN (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 27—64. Compare this vol., ii, 90).—A theoretical résumé is given of the experimental work performed by the author and other investigators on the crystalline and colloidal states of matter.

It is claimed that the conclusions arrived at regarding the discontinuity and crystalline structure of all forms of matter, whether liquid, solid, or gaseous, and the non-existence of amorphous substances, are based on purely experimental evidence.

It is incorrect to say that, since chemically-pure colloids are unknown, therefore they are complexes of the suspended substance with the solvent, for any inorganic colloid can be obtained in a pure state by recrystallisation from a solvent which dissolves it appreciably; on the other hand, any crystalline substance can be obtained in such minute crystals as to render it difficult to free it from the remnants of water or other matter absorbed by it. Z. K.

Physico-chemical Investigations on Soaps Considered as Colloids. ANDRÉ MAYER, GEORGES SCHAEFFER, and E. F. TERROINE (*Compt. rend.*, 1908, **146**, 484—487).—An examination of the optical properties of solutions of soaps of the fatty acid series shows that the acetate, propionate, butyrate, and valerate form homogeneous solutions in acid, alkaline, or neutral aqueous, or in alcoholic alkaline solution; the hexoate, octoate, laurate, palmitate, oleate, and stearate yield colloidal solutions or jellies, according to the complexity of the molecule and the nature of the medium. These colloidal solutions are caused by the hydrolysis of the salts and partial or complete precipitation of the fatty acid.

The viscosity of solutions of the lower members of the series is only slightly altered by the addition of acids, but increased by the addition of bases; but in the case of the hexoate and the higher members of the series, the viscosity of the solution is increased either by the addition of an acid or a base, and the minimum point on the viscosity curve is a critical point coinciding with the first appearance of ultramicroscopical granules in the solution. M. A. W.

The Process of Gelatinisation. IV. S. A. LEVITES (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 237—241; see this vol., ii, 161).—A solution of gelatin in dilute formaldehyde gelatinises, owing to the conversion of the gelatin into an insoluble substance. The change is very slow at low temperatures. Salts of univalent ions and non-electrolytes retard the change about equally; salts of bivalent ions have a greater effect. Hydrogen ions retard the change very much, and hydroxyl ions accelerate it enormously. By prolonged boiling with water, glutin, sodium α-thymus-nucleates, and agar-agar are converted into substances which do not set. The change is accompanied by a diminution of the viscosity of the solution, which is measured and reproduced in curves. T. E.

The Equilibrium $2\mathrm{Au(metal)} + \mathrm{Au}^{\cdot\cdot\cdot} \rightleftarrows 3\mathrm{Au}^{\cdot}$. EMIL BOSE (*Zeitsch. Elektrochem.*, 1908, **14**, 85—86).—By means of the apparatus described previously (Abstr., 1907, ii, 735), it is shown that the equilibrium in question exists (this had already been proved by Wohlwill, Abstr., 1899, ii, 105), and that it is displaced in the direction of aurous ions by rise of temperature. T. E.

Temperature-coefficients of Ionic Mobilities in Water as a Function of the Mobilities. FRIEDRICH KOHLRAUSCH (*Zeitsch. Elektrochem.*, 1908, **14**, 129—133).—The formula proposed by Rasch and Hinrichsen (this vol., ii, 148, 149), $a = A/\log l$, where a is the temperature-coefficient and l the mobility, requires another constant, owing to the fact that l is really the product of a number and the dimensions of the unit of conductivity. If l is expressed in *C.G.S.* units, the original formula gives impossible results.

By plotting all known temperature-coefficients against the corresponding mobilities, it is seen that the ions formed of univalent elements lie on a smooth curve, whilst univalent compound ions (except OH and NH_4) lie below the curve and bivalent ions lie above it. For the univalent elementary ions, four formulæ are tried: (1) $a = 0{\cdot}0136 + 0{\cdot}67/(18{\cdot}5 + l)$; (2) $a = 0{\cdot}01341 + 0{\cdot}640/l - 6{\cdot}94/l^2$; (3) $a = 0{\cdot}03481/\log l - 0{\cdot}207$; (4) $a = 0{\cdot}0394/\log l$. The first three agree with the experimental results within the limits of error, and the fourth gives a systematic deviation. The first formula (which was used by the author in 1901) is the only one which gives probable values for a when l becomes very large or very small. The ions probably carry with them an envelope of water molecules, the size of which depends on the nature of the ion; the arguments for this view are summarised. T. E.

Reactivity of Undissociated Electrolytes. RUDOLF WEGSCHEIDER (*Zeitsch. Elektrochem.*, 1908, **14**, 133).—Referring to Meyer and Trutzer's work on the decomposition of ammonium nitrite (this vol., ii, 181), the author points out that it is impossible to decide from measurements of the velocity of reaction whether undissociated molecules or ions react, the result being the same so long as the two are in equilibrium. The same applies to the change of trichloroacetic acid into chloroform and carbon dioxide studied by Timoféeff and Koboseff (Abstr., 1904, i, 470). T. E.

Theory of the Inversion of Sucrose. JULIUS MEYER (*Zeitsch. physikal. Chem.*, 1908, **62**, 59—88).—In view of the birotation of dextrose and lævulose, the inversion of sucrose by dilute acids cannot be a simple unimolecular reaction; it is to be regarded as a reaction completed in several stages, which may be represented by the scheme:

$$\begin{tikzcd}
 & \alpha\text{-Dextrose} \arrow[r, shift left, "k_3"] & \beta\text{-Dextrose.} \arrow[l, shift left, "k_4"] \\
\text{Sucrose} \arrow[ur, "k_5"] \arrow[dr, "k_5"'] & & \\
 & \alpha\text{-Lævulose} \arrow[r, shift left, "k_1"] & \beta\text{-Lævulose.} \arrow[l, shift left, "k_2"]
\end{tikzcd}$$

On this basis, a general formula is deduced which permits the calculation of the angle of rotation of a solution at any moment from the reaction constants and the specific rotatory powers of the components, and which gives also the concentration of each constituent at any given time.

In order to study the various separate changes involved in the inversion of sucrose, the author has investigated the mutarotation of dextrose at 18° and 25° in water and in dilute hydrochloric acid solution. For α-dextrose, the mean value of $[\alpha]_D$ is 109·575°; for β-dextrose, 20·460°, and for the equilibrium mixture, 52·335°. The value of $k_3 + k_4$ has been determined experimentally, and the separate values of k_3 and k_4 which follow from these data are given below:

Temperature.	k_3.	k_4.	
18°	0·00747	0·00415	in water
25	0·01513	0·00844	
18	0·01147	0·00638	in 0·02N HCl
25	0·02609	0·01452	

The equilibrium between α- and β-dextrose is not noticeably displaced either by the presence of acid or by rise of temperature.

In the case of α- and β-lævulose, the sum $(k_1 + k_2)$ only of the velocity coefficients of the opposing reactions has been determined. On rise of temperature, the equilibrium is shifted in the direction of β-lævulose.

In its very earliest stages, as careful experiments have shown, the inversion of sucrose is not a simple unimolecular reaction; the velocity coefficient, calculated on the supposition that it is such a reaction, diminishes as inversion proceeds. Only after inversion has taken place to the extent of 4—5% does its course correspond with that required for a unimolecular reaction. When the curve obtained by plotting the inversion coefficient against time is extrapolated to zero time, an approximate value is obtained for k_5, the true inversion constant. When this value of k_5 is inserted in the general formula already mentioned, the latter can be considerably simplified, and ultimately reduced to the unimolecular form. For the inversion of an 8% sucrose solution by 0·02*N* HCl, the value of k_5 is found to be 0·000050 at 18°, and 0·000150 at 25°. The temperature-coefficient is 4·5 for an interval of 10°.

A formula representing the change of rotation of a solution containing dextrose and lævulose is deduced and tested by experiment with satisfactory results. J. C. P.

A New Method for Studying Intramolecular Change. Thomas S. Patterson and Andrew McMillan (*Ber.*, 1907, **40**, 2564—2573).—In continuation of work previously published (Trans., 1907, **91**, 504), the authors have determined the rate of change of anis-*syn.*-aldoxime into the *anti*-isomeride, when dissolved in various esters, by observing the change in the rotatory power of the ester. The following values have been obtained for 1000k: in methyl tartrate, 3·0; ethyl tartrate, 1·8; *n*-propyl tartrate, 1·0; methyl malate, 5·0; ethyl malate, 6·7; *n*-propyl malate, 8·4. The value for k diminishes with increasing mol. weight of the tartrate, but increases with increasing mol. weight of the malate. The high value, $1000k = 3·9$, previously observed for anis-*syn.*-aldoxime in ethyl tartrate solution (*loc. cit.*) is ascribed to the use of an impure oxime.

The rotatory power of a solution of *m*-nitrobenz-*syn.*-aldoxime in *n*-propyl tartrate, containing 5·05% of the aldoxime, changes from α_D^{20} (100 mm.) +18·14° to α_D^{20} (100 mm.) +14·68°; $1000k = 0·5$. An ethyl tartrate solution containing 5·04% of *m*-nitrobenz-*anti*-aldoxime has $\alpha_D^{19·8}$ (100 mm.) +14·68° (compare Ciamician and Silber, Abstr., 1904, i, 161; Goldschmidt, Abstr., 1904, i, 250; Ciusa, Abstr., 1907, i, 137). G. Y.

Catalytic Reactions at High Temperatures and Pressures. XVI. Function of Oxides in Catalysis. Wladimir N. Ipatieff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1—27. Compare Abstr., 1907, i, 5, 6, 457, 827, 828).—To determine the rôle of the catalyst nickel oxide in hydration and dehydration processes, it is necessary in the first place to study its behaviour on reduction at ordinary and at high pressures. The conclusions arrived at by Moissan regarding the reduction of this oxide (Abstr., 1881, 77) are mostly inaccurate, owing to the fact that he did not analyse the original material.

Pure commercial nickel oxide contains far more nickel than that necessary for the formula Ni_2O_3, is not always of constant composition, and contains about 6% water, which it commences to lose at 120°, but loses the last traces only above 300°. It is probable that the main constituent is really the lower oxide NiO. The best reagent for detecting even very minute quantities of nickel produced by the reduction of the oxides is nitric acid, D 1·38—1·40, which, whilst producing no effect on the oxides, evolves oxides of nitrogen in the presence of nickel, and it is even possible to estimate the latter by the appearance of the reacting mixture.

At the ordinary pressure, nickelic oxide is reduced by hydrogen at 170—190°, forming metallic nickel and lower oxides, mostly NiO, but it is improbable that the oxide Ni_3O_4 is formed. Nickelous oxide, NiO, only commences to be reduced above 200°, and cannot be oxidised either with dry or moist oxygen even at 480°. At high pressures, nickelic oxide is reduced at 180°, and at 210° pure nickel is produced; nickelous oxide under the same conditions yields almost pure nickel at 172°.

In all cases, the reduction of the oxides is either prevented or greatly retarded when any water is removed by previous heating. The temperature of reoxidation of the reduced nickel depends on the temperature at which it was produced, and is lower when moist oxygen or air is employed; in any case only nickelous oxide is formed.

When the reduction of benzene is performed at high pressures in the presence of nickelic oxide, both the organic substance and the oxide are only very slowly reduced unless precautions are taken not to wet the oxide with the liquid. Employing nickelous oxide, both the benzene and the oxide are readily reduced at 172°, but not if the oxide has been previously well dried.

Comparing the velocity of reduction of benzene in the presence of nickelic oxide, nickelous oxide, and reduced nickel, $(\delta\rho/\delta\iota)_{max.}$ is found to be greatest for the first and least for the last. It is thus evident that the oxides form the most important part of the catalyst in these reactions, the traces of water always present in the oxides employed being as important in these cases as they are in catalytic processes of oxidation. Thus, in presence of reduced nickel, which always contains the oxides and water, hydrogen under pressure reduces the oxide, forming the metal and water, which in their nascent state react on one another, reproducing the oxide and nascent hydrogen, which hydrogenates rapidly the organic compound.

The current ideas regarding catalytic reactions require modification in the light of the facts disclosed by the study of heterogeneous catalysis at high temperatures and pressures. Thus it is probably not true that a catalyst merely increases the speed of a reaction which otherwise proceeds at a slow rate; firstly, the catalyst often alters the limits of a reaction, and, secondly, it seems more probable that it acts as a transformer of heat into chemical energy.

To understand the different catalytic actions displayed by various metals, it is necessary to study their chemical properties and also those of their oxides. Z. K.

Kinetics of the Elimination of Carbon Dioxide from Camphorcarboxylic Acid. GEORG BREDIG and R. W. BALCOM (*Ber.*, 1908, **41**, 740—751).—In aqueous solution, the decomposition of *d*-camphorcarboxylic acid when heated follows a mass action law of the first order. Substitution of dilute hydrochloric acid for water led to no increase in the rate of change. The sodium salt decomposes very much less rapidly than the free acid, and the rate of change of the salt is only slightly depressed by excess of alkaline hydroxide. The temperature-coefficient is large, being 3·15 for 10°. In benzene solution it is 3·0.

The decomposition obeys a similar mass action law in benzene, aniline, alcohol, phenetole or ether; in heptane and acetone solution this is not the case, and the velocity constant increases as the reaction proceeds. In ethyl alcohol, a simultaneous esterification and elimination of carbon dioxide takes place. The influence of the solvent on the rate of change is very large, the change being particularly rapid in aniline and alcohol.

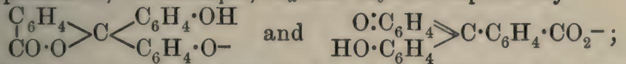
The decompositions of both *d*- and *l*-camphorcarboxylic acids in *d*- and *l*-limonene solutions do not follow mass action laws of the first or second order, but the four reaction curves, when plotted, appear to be identical within the limits of error. This is not apparently a suitable case for the detection of stereochemical differences in the catalytic action of the solvent (see following abstract). E. F. A.

Stereochemistry of Catalysis. GEORG BREDIG and K. FAJANS (*Ber.*, 1908, **41**, 752—763).—The decomposition of the optically active camphorcarboxylic acids is studied, not in an indifferent optically active medium as formerly (see preceding abstract), but in presence of an optically active pronounced base, such as nicotine, used either alone as solvent or diluted with an indifferent substance. Under these conditions, the elimination of carbon dioxide follows a unimolecular reaction of the first order. In nicotine solution, the *d*-acid decomposes about 13% more quickly than the *l*-acid; in nitrobenzene solution, containing 5% of nicotine, the *d*-acid is decomposed 8% more rapidly than its isomeride, and nine times as quickly as when no nicotine is present, showing the powerful catalytic activity of the base. In acetophenone solution containing 10% of nicotine, the *d*-acid is attacked 17% more quickly than the *l*-acid.

The stereochemical conditions of the catalysis of optically active substances by optically active catalysts are thus very similar to those in the case of enzyme action, and, adopting the analogy from enzymes, it is considered that there is an intermediate temporary formation of an additive compound between catalyst and substrate. The results are parallel to Dakin's (Abstr., 1904, i, 1071; 1905, i, 556) observations on the hydrolysis of mandelic acid esters by lipase. E. F. A.

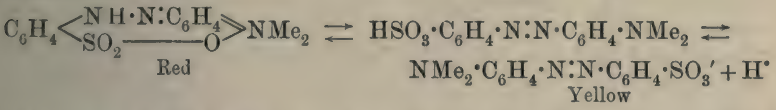
The Relationship between the Strength of Acids and their Capacity to Preserve Neutrality. LAWRENCE J. HENDERSON (*Amer. J. Physiol.*, 1908, **21**, 173—179).—Acids the ionisation constant of which is nearly equal to the hydrogen ionisation at neutrality, possess with the help of their salts a great capacity for preserving neutrality in simple solution, whilst other acids in like concentration have relatively little effect in this direction. W. D. H.

Constitution of Indicators used in Acidimetry. JOHN T. HEWITT (*Analyst*, 1908, **33**, 85—89. Compare Hewitt and Mitchell, Trans., 1907, **91**, 1251).—In order that a substance may act as an indicator, it must be a weak acid or a weak base, and the complex ion which it forms must have a different constitution to the parent substance. Weakly acidic indicators are present in solution in a state of equilibrium represented thus: $X_uH \rightleftharpoons X_vH \rightleftharpoons X_v' + H^{\cdot}$, where X_u and X_v are isomeric complex radicles. In the case of phenolphthalein, for example, X_u and X_v are respectively



$$\begin{matrix}C_6H_4\\ |\\ CO\cdot O\end{matrix}\!>\!C\!<\!\begin{matrix}C_6H_4\cdot OH\\ C_6H_4\cdot O-\end{matrix} \quad \text{and} \quad \begin{matrix}O{:}C_6H_4\\ HO\cdot C_6H_4\end{matrix}\!>\!C\cdot C_6H_4\cdot CO_2-;$$

since X_u is the stable configuration and the substance is a very weak acid, X_vH and its ions are only present to an exceedingly small extent in neutral solution, and the absorption due to X_u is observed (with phenolphthalein this is in the ultra-violet and the substance is colourless). Addition of bases removes the hydrogen ions, the equilibrium is disturbed towards the right, and the colour due to X_v makes its appearance. In the case of methyl-orange, the aqueous solution will contain the internal salt, the real dimethylaminoazobenzenesulphonic acid, and the ions of the latter in a state of equilibrium, thus:



$$\underset{\text{Red}}{C_6H_4\!<\!\begin{matrix}NH\cdot N{:}C_6H_4\\ SO_2\text{———}O\end{matrix}\!>\!NMe_2} \rightleftharpoons HSO_3\cdot C_6H_4\cdot N{:}N\cdot C_6H_4\cdot NMe_2 \rightleftharpoons$$
$$\underset{\text{Yellow}}{NMe_2\cdot C_6H_4\cdot N{:}N\cdot C_6H_4\cdot SO_3' + H^{\cdot}}$$

Addition of a weak base results in the removal of hydrogen ions, and the solution becomes yellow.

It is stated in conclusion that extremely sharp results are obtained by using 1-nitro-2-sulphobenzene-4-azo-α-naphthol as an indicator. The acid and its monobasic salts are yellow; addition of excess of alkali turns the yellow solution sharply to a purple; the purple colour is not discharged by an excess of alkali, hot or cold, neither is it affected by alcohol even in strongly alkaline solutions.

W. H. G.

Symmetry in the Law of Atomic Weights. N. DELAUNAY (*Chem. News*, 1908, **97**, 99. Compare Abstr., 1908, ii, 97).—The elements are arranged on a set of curves with the numbers 0, 1, 2, 3; 3, 2, 1, 0 successively as ordinates, and the atomic weights commencing with helium as abscissæ. The curve obtained for each period of eight elements is completely symmetrical; in other words, the elements of each period fall into pairs the sum of the atomic weights of which is constant. Thus, in the first two periods:

$$He + F = Li + O = Be + N = B + C = 23,$$
$$Ne + Cl = Na + S = Mg + P = Al + Si = 55{\cdot}3.$$

R. J. C.

Demonstration of the Formation of Ammonium Amalgam by Electrolysis of Ammonium Chloride. JOHANNES SCHROEDER (*J. pr. Chem.*, 1908, [ii], **77**, 271—272).—The author describes and figures two simple pieces of apparatus designed to enable a large audience to observe the formation of ammonium amalgam by electrolysis of ammonium chloride with a mercury cathode. G. Y.

Three Lecture Experiments. EDMUND KNECHT (*Ber*, 1908, **41**, 498—499).—1. *Synthesis of Calcium Carbide.*—Small quantities of calcium carbide are readily prepared by igniting a piece of calcium, about the size of a pea, placed on wood-charcoal, by means of a small blowpipe flame; the metal burns for a moment with an intense orange-yellow flame, and then sinks into the charcoal. The calcium carbide formed is readily obtained by breaking the piece of charcoal.

2. *A Visible Autoxidation.*—An approximately *N*/10 potassium permanganate solution acidified with sulphuric acid is divided into two portions. One portion is kept for comparison; small quantities of titanous sulphate are added from time to time to the other portion, the blood-red colour of which gradually changes through scarlet to orange-yellow. Excess of the salt decolorises the solution.

3. *Precipitation of Metallic Copper by Titanous Sulphate.*—About 1 c.c. of a 10% copper sulphate solution is added to a 1—2 litre glass cylinder nearly full of water; about 5 c.c. of a solution of titanous sulphate is then stirred into the solution from which metallic copper separates in a few minutes. The precipitate is so fine that most of it passes through a filter paper, and the solution which appears copper-coloured by reflected light is blue by transmitted light. The reaction may be employed as a test for copper, since it is visible in the presence of 1 part of copper per 1,000,000 parts of solution.

W. H. G.

New Pressure Cylinder. BALTHASAR PFYL and BR. LINNE (*Chem. Zeit.*, 1908, **32**, 205).—The pressure cylinder, previously described by the authors (Abstr., 1905, ii, 770), has been in use for more than two years, and continues to act in a satisfactory manner. T. H. P.

Gas Current Pressure Regulator. FREDERICH M. G. JOHNSON and K. BUCH (*Ber.*, 1908, **41**, 640—641).—An apparatus to regulate the pressure of a gas current has been designed on the principle of the electromagnetic thermo-regulator, and is here described and figured.

G. Y.

A Laboratory Pump. ROBERT LUTHER (*Chem. Zeit.*, 1908, **32**, 267—268).—The pump, which is driven by an electro-motor, is designed for driving a continuous stream of water through thermostats or condensers. It consists of four tubes arranged in the form of a cross, which rotates about a vertical axis in a metal box. The water enters the cross from below by a pipe at the centre of the cross and passing through the bottom of the metal box, the rotation of the cross draws the water up and forces it out into the metal box, from which it passes out by a side tube. P. H.

Inorganic Chemistry.

Purification of Hydrogen from Arsenic. Hans Reckleben and Georg Lockemann (*Zeitsch. angew. Chem.*, 1908, 21, 433—436).—The absorption of arsine, when mixed with hydrogen, has been studied previously (this vol., ii, 176, 224) by shaking the mixed gases with various reagents. An account is now given of the results obtained on passing the mixed gases through most of the reagents previously employed, and, in addition, mercuric chloride and silver nitrate solutions, and a mixture of cupric and cuprous oxides (Lionet, Abstr., 1880, 2). For the purification of hydrogen in the laboratory, it is recommended to pass the gas through a saturated solution of potassium permanganate, and, finally, to test the purity of the gas, through a 5—10% solution of silver nitrate, when the presence of traces of arsenic is shown by the formation of a precipitate. Mercuric chloride solution can be employed only so long as the precipitate formed is yellowish-white. Copper oxide forms the best solid absorbent; iodine may be used if the hydrogen is afterwards passed through a wash-liquid to retain hydrogen iodide and traces of iodine vapour. Only potassium hypochlorite solution, dropped on to pumice stone or bleaching powder kept thoroughly moistened with water, is suitable for use on the technical scale. It is recommended to employ bromine when traces of arsine have to be removed from large volumes of hydrogen. G. Y.

Decomposition of Hydrogen Peroxide in the Presence of Various Substances. Eduardo Filippi (*Chem. Zentr.*, 1907, ii, 1890; from *Arch. Farm. sperim.*, 1907, 6, 363—395).—The author finds that all inert powders decompose hydrogen peroxide, the velocity of decomposition being proportional to the exposed surface of the added powder and independent of the concentration of the hydrogen peroxide. Various ferment-containing organic substances which give the guaiacum reaction, and also ferment-free organic substances which cannot give this reaction, decompose hydrogen peroxide. Therefore the conclusion is drawn that these tests are insufficient to establish the nature of the ferment present in a substance. J. V. E.

Atomic Weights of Nitrogen, Oxygen, and Carbon. Anatole Leduc (*Compt. rend.*, 1908, **146**, 399—400).—The value N = 14·01 adopted by the International Committee on Atomic Weights, and based on Guye's recent determinations, is greater than the value N = 14·005 obtained by the author (Abstr., 1897, ii, 549). Using the value N = 14·01 and the ratio of the densities of carbon monoxide and nitrogen determined by Lord Rayleigh (Abstr., 1895, ii, 444; 1898, ii, 290) and the author (Abstr., 1893, ii, 165; 1897, ii, 140), the atomic weight of carbon lies between 12·011 and 12·16; whilst taking C = 12·000, the atomic weight of nitrogen lies between 14·002 and 14·004. M. A. W.

Formation of Oxides of Nitrogen in the Ozone Generator. WILHELM MANCHOT (*Ber.*, 1908, **41**, 471—472).—In connexion with the study of the action of ozone on alkalis (Manchot and Kampschulte, this vol., ii, 101), it has been observed that on prolonged exposure to a current of ozone, prepared from 98% oxygen, the coloured compounds at first formed with alkalis are decolorised and converted into nitrates (Warburg and Leithaüser, Abstr., 1906, ii, 743). The presence of nitric oxide in ozone prepared from 99·3% oxygen has been determined in the same manner. On passing 10% ozone slowly through 15% potassium hydroxide, the concentration falls to 4%; the resulting gas, which is free from nitric oxide, has not an acid reaction, and does not increase the conductivity of water, but behaves towards organic and inorganic bases as described previously (*loc. cit.*). Hence, contrary to Baeyer and Villiger's view (Abstr., 1902, ii, 650), ozone is not an acid anhydride. G. Y.

Irregularities in the Combination of Nitric Oxide and Oxygen. ALFRED MANDL and FRANZ RUSS (*Zeitsch. angew. Chem.*, 1908, **21**, 486—491).—It is usually assumed that nitric oxide and oxygen, when mixed in the proportion of 2 vols. to 1 vol., undergo complete combination. This is found to be not always the case, the reaction often coming to an end whilst considerable amounts of nitric oxide and oxygen are still uncombined. The results of experiments quoted show that the extent to which the combination takes place depends on the genesis of the oxygen, about 97% of the nitric oxide combining with oxygen prepared from air by Linde's method, about 95% with oxygen obtained by electrolysis of water and passed over heated palladium asbestos, but only about 40% with oxygen prepared by the action of potassium dichromate and sulphuric acid on barium peroxide. As the reaction takes place also to a much smaller extent with oxygen prepared by electrolysis of water but not passed over palladium asbestos, the retardation might result from the presence of hydrogen peroxide. This could not be tried, but comparative experiments with Linde's oxygen and the same oxygen after ozonisation show that the combination is markedly retarded by the presence of ozone. This retardation may be a direct action of the ozone, or may result from the destruction by the ozone of some catalyst necessary to the reaction. G. Y.

Nitrogen Sulphide. HANS WÖLBLING (*Zeitsch. anorg. Chem.* 1908, **57**, 281—289).—Certain compounds of nitrogen sulphide, N_4S_4, with the higher halogen derivatives of certain elements have been prepared, and a reduction product of nitrogen sulphide has been obtained by the action of stannous chloride in alcoholic solution on the sulphide. Unless otherwise mentioned, the compounds were obtained by interaction of the components dissolved in carbon tetrachloride.

The *compound*, $N_4S_4,TiCl_4$, occurs as an amorphous, brownish-red precipitate, insoluble in most solvents; it decomposes in moist air, reacts very vigorously with water and with alkali, and is split up into its components by hydrochloric acid and by alcohol. The *compound*, $N_4S_4,SbCl_5$, occurs as a scarlet, amorphous powder, which is very stable, not being attacked by water, by hydrochloric or by nitric acid in the cold; it yields ammonia on heating with potassium hydroxide. The *compound*, $2N_4S_4,SnCl_4$, occurs as an amorphous, insoluble, Bordeaux-red powder, which behaves towards reagents like the antimony compound; it decomposes when heated above 160°.

The *compound*, N_3S_4Cl (compare Muthmann and Seither, Abstr., 1897, ii, 255), can be prepared conveniently by heating nitrogen sulphide with the theoretical amount of sulphur dichloride, S_2Cl_2, in carbon tetrachloride solution for two hours in a reflux apparatus. The corresponding *bromide*, N_3S_4Br, appears to be obtained by interaction of nitrogen sulphide and sulphur dibromide, S_2Br_2, dissolved in carbon tetrachloride, but in carbon disulphide solution only the *compound*, N_4S_5Br, was obtained. Nitrogen sulphide and selenium dichloride, Se_2Cl_2, react in boiling carbon tetrachloride to form a green, insoluble, amorphous *compound*, probably N_4S_4,Se_2Cl_2, which has not been obtained pure. This compound is not affected by water or hydrochloric acid, but is decomposed immediately by nitric acid and by potassium hydroxide.

By the action of hydrogen sulphide on nitrogen sulphide dissolved in benzene and in alcohol, precipitates of ammonium polysulphides and of ammonium thiosulphate respectively were obtained.

Stannous chloride does not combine directly with nitrogen sulphide, but in warm benzene solution the latter compound is reduced, and a compound of the empirical formula NSH separates in yellow, lustrous leaflets, which, after recrystallisation from pyridine, have m. p. (decomp.) 152°. The new compound is not combustible or explosive, is not acted on by cold potassium hydroxide, but gives off ammonia when heated; with hydrochloric acid, sulphur dioxide is given off, and it reacts vigorously with nitric acid. Its constitution has not yet been determined. G. S.

The Essentially Chemical Causes of the Allotropic Transformation of Phosphorus Dissolved in Oil of Turpentine. ALBERT COLSON (*Compt. rend.*, 1908, **146**, 401—403).—The gradual and irreversible change to the red modification that phosphorus dissolved in oil of turpentine undergoes at 250° (this vol., ii, 35, 176) is due to the formation of small quantities of hydrogen phosphide and its subsequent decomposition into red phosphorus and hydrogen, the latter reacting with the dissolved phosphorus to form a further quantity of hydrogen phosphide. A 2% solution of phosphorus in oil of turpentine was sealed in a tube with hydrogen phosphide and enclosed in a tube containing a further quantity of the solution. After heating at 240° for four hours, the inner tube contained a copious deposit of red phosphorus, whilst the contents of the outer tube remained clear even after twelve hours at 250°. The red phosphorus formed under these conditions has D 2·095, and contains small quantities of the phosphides of hydrogen, which are eliminated on distillation in a vacuum.

Phosphorus dissolved in an oxygenated solvent, such as ethyl benzoate, does not undergo any allotropic transformation even when the solution is heated at 305—310° for twenty-five hours. M. A. W.

Hittorf's Phosphorus. Alfred Stock (*Ber.*, 1908, **41**, 764).—The crystallographic determinations cited in the previous communication (this vol., ii, 176) were made by F. von Wolff. E. F. A.

Phosphoryl Bromide. Ernest Berger (*Compt. rend.*, 1908, **146**, 400—401).—A convenient method of preparing phosphoryl bromide consists in gently heating a mixture of phosphorus pentabromide and phosphoric oxide until traces of bromine vapour appear; after four to five hours, the liquid product is distilled over a little phosphoric oxide; the reaction is represented by the equation $3PBr_5 + P_2O_5 = 5POBr_3$, and the yield amounts to 85% of that theoretically possible. Phosphoryl bromide forms colourless crystals, m. p. 55—56°, b. p. 189·5°/774 mm., and the heat of formation as determined by decomposing the compound with water is 75900 cal. (compare Ogier, Abstr., 1881, 218). M. A. W.

Sulphides of Phosphorus. II. Phosphorus Pentasulphide. Alfred Stock and Wilhelm Scharfenberg (*Ber.*, 1908, **41**, 558—564. Compare Abstr., 1905, ii, 703).—By the distillation of phosphorus pentasulphide in a high vacuum, Stock and Thiel (Abstr., 1905, ii, 703) observed the formation of another substance in addition to pure phosphorus pentasulphide, m. p. 276°. A special apparatus is now described in detail which enabled the distillation of larger quantities in a high vacuum and rapid cooling of the vapour. This had, in particular, the advantage that the phosphorus pentasulphide distilled at a much lower temperature than formerly, and the distillate contained but little else than pentasulphide. When superheated even in a high vacuum, phosphorus pentasulphide decomposes; the density is normal at 630°, but rapidly becomes less above this temperature. Phosphorus pentasulphide when distilled or sublimed decomposes somewhat at atmospheric pressure, decomposes more in a high vacuum or in a stream of carbon dioxide, and still more when the vapours are superheated. E. F. A.

Sulphides of Phosphorus. III. Vapour Densities of the Compounds P_4S_3, P_4S_7, and P_2S_5. Alfred Stock and Heinrich von Bezold (*Ber.*, 1908, **41**, 657—660. Compare Abstr., 1905, ii, 703; this vol., ii, 176).—The existence of only three, P_4S_3, P_4S_7, and P_2S_5, of the numerous compounds of phosphorus and sulphur described in the literature can be considered as established. The vapour density determinations made with these three substances by various authors have given normal results, but in no case is the temperature of the determination recorded. The present authors have therefore determined the vapour densities of the three compounds at temperatures up to 1000°. A Victor Meyer's apparatus, made of glazed porcelain, filled with nitrogen, and heated in a Heräus's resistance-oven was employed. The temperatures were recorded by means of a thermo-element. The results are tabulated and expressed in the form of curves. All three compounds decompose at a red heat; the compound P_2S_5 commences to decompose immediately above its b. p., whereas P_4S_3 and P_4S_7 give normal results at temperatures considerably above their b.p.'s. Hence these two compounds can be distilled under the ordinary pressure, only P_4S_3 undergoing slight decomposition (Mai and Schaffer, Abstr., 1903, ii, 363). Remarkable is the rapid fall in the vapour density of P_4S_7 between 750° and 800°. G. Y.

Yellow Arsenic. HUGO ERDMANN (*Ber.*, 1908, **41**, 521—523).—Many of the results published by Linck in his paper on the polymorphous modifications of the phosphorus–arsenic group (this vol., ii, 176) were communicated to him by the author and Reppert, who intend to publish their own work, the more so as Linck's statements as to it are frequently incorrect. C. S.

Solubility of Graphite in Iron. CARL BENEDICKS (*Metallurgie*, 1908, **5**, 41—45).—A sample of iron containing 3·9% carbon and 0·75% silicon was repeatedly heated rapidly to 800°, and then slowly cooled. By this treatment, the whole of the carbide was decomposed, the mass consisting only of ferrite and graphite. This iron was then heated for two hours at 940° and quenched. The microscopic examination then showed the presence of martensite, troostite, sorbite, and perlite. This indicates a considerable solubility of graphite in iron at 940°, amounting to about 1%, a fact in accordance with the older views as to the stable iron–carbon system, and not with the theories of Heyn and Ruer. C. H. D.

Conversion of Diamond into Coke in High Vacuum by Cathode Rays. CHARLES A. PARSONS and A. A. CAMPBELL SWINTON (*Proc. Roy. Soc.*, 1908, **80**, *A*, 184—185).—The vacuum tube employed was provided with two concave aluminium electrodes, so arranged as to focus the rays on the diamond, which rested on an iridium support. Two diamonds, each about 0·2 in. in diameter, were employed, and an alternating current was used. With an *E.M.F.* of 8000 volts and a current of 44 milliamperes, the diamond began to throw off small sparks; at 9600 volts and 45·5 milliamperes it commenced to blacken, and at 11,200 volts and 48 milliamperes appeared to be converted completely into coke. The temperature at which disintegration took place, as measured by an optical pyrometer, was 1890°.

It was not found possible to determine whether the gas pumped off from the tube during the experiment originated from the diamond or from the rest of the apparatus, neither could a marked difference be detected in specimens of gas removed from the vacuum tube just before and just after conversion. G. S.

Action of Alkali Salts of a Fixed Base on the Combustion of Gases and Combustible Powders. DAUTRICHE (*Compt. rend.*, 1908, **146**, 535—538).—The author has detonated cartridges, made of explosives, either alone or mixed with small proportions of certain salts, in a large vessel full of air, and determined the proportion of the evolved gases (hydrogen and carbon monoxide) burnt by measurement of the heat developed. A decanitrated cotton developed less than half as much heat when mixed with 3% of potassium sulphate as when detonated alone. One to two per cent. of sodium hydrogen carbonate, or 2% of potassium nitrate, effects a slightly less reduction in the amount of heat developed, whilst calcium and magnesium carbonates and lead nitrate have only about one-half the effect. With a nonanitrated cotton, the heat developed is reduced about 60% by addition of 10% of sodium hydrogen carbonate. Trinitrotoluene when mixed with 5% of potassium nitrate develops only one-fourth as much heat as when detonated alone; the effect of barium nitrate is only one-third as great. These results show that the combustion of the products of detonation of explosives can be prevented by addition of small amounts of sodium or potassium salts, and that such an addition should be made to explosives used in mines containing fire-damp. It is shown that addition of 3% of sodium hydrogen carbonate to a mixture of a decanitrated cotton (30%) with ammonium nitrate (70%) prevents inflammation when detonated. Potassium nitrate has a similar effect on a mixture of trinitrotoluene and ammonium nitrate. The conclusion is drawn that a cloud formed of the powder of any sodium or potassium salt whatever tends to prevent the combustion of gases and combustible powders, whilst salts of the alkaline-earth metals have only a secondary action. E. H.

Combustion without Flame and the Inflammation of Gases at the End of a Metallic Rod. JEAN MEUNIER (*Compt. rend.*, 1908, **146**, 539—540).—An interesting experiment with an alcohol-fed incandescent burner is described. The burner has the form of an æolipile supported on four tubes through which cotton wicks pass supplying the alcohol. The æolipile has an annular form, the flame rising from a central cylinder which is covered with a convex disc, perforated with closely occurring holes. An iron stem 8 cm. long, supporting the mantle, rises from the centre of the disc. It is observed that after continued use the light becomes less bright, and that the darkening of the mantle commences at the moment that the disk reddens. After removal of the mantle, the author succeeded in getting the disk to redden without production of a flame. Once the disk is red hot, its incandescence increases with the supply of alcohol vapour. It is impossible to ignite either a pad moistened with alcohol, a wick soaked in light petroleum, or a wooden match by bringing them near the hot disc, although the wood of the match is charred. This flameless combustion occurring on the surface of the disk is to be explained by the retention of either the combustible gas or the oxygen on this surface, as suggested by Couriot and Meunier (this vol, ii, 11) in the case of the non-explosion of an explosive mixture by an incandescent filament. Application of a lighted match to the upper end of the metallic stem results in the production of a flame at this point, which continues to burn so long as it is protected from draughts, showing that the oxygen is retained by the disk, and that the excess of combustible gas rises around the stem without mixing with the surrounding air and without igniting, although the stem is at a fairly high temperature. The shape of the flame is altered by varying the form of the upper extremity of the metallic rod.

The experiment, besides its important bearing on the mechanism of combustion by incandescence, seems to show that gases have a certain amount of cohesion. E. H.

[Preparation of Silicon Monoxide.] HENRY N. POTTER (D.R.-P. 189833).—When silica is heated electrically in an inert atmosphere with sufficient reducing agent (carbon or silicon carbide) to remove half its oxygen, it is converted into a very voluminous, brown powder, which contains 91·28% of *silicon monoxide*, SiO. This oxide, which has D 2·24, is much less soluble than silica in hydrofluoric acid, but dissolves more readily in aqueous alkali hydroxides; it is a bad conductor of heat or electricity. The monoxide exists in the vitreous condition. G. T. M.

Tschermak's Method of Preparing Silicic Acids from Natural Silicates. OTTO MÜGGE (*Centr. Min.*, 1908, 129—134. Compare Abstr., 1906, ii, 771; Ann. Rep., **2**, 273; **3**, 303).—Tschermak's method is criticised, and the determinations are repeated for natrolite. The position of the break in the drying curve is found to vary greatly with the temperature at which the silica jelly dries: at 9°, corresponding with 33·5—46% H_2O, and at 33·3° with 20% H_2O. Further, the break in the curve is never very sharply defined, and its position cannot be accurately estimated to within 1 or 2 per cent., and some of the complex silicic acids assumed by Tschermak do not differ from one another by more than this amount. L. J. S.

Rare Gases of Thermal Waters. Gaseous Outputs of Some Springs. CHARLES MOUREU and ROBERT BIQUARD (*Compt. rend.*, 1908, **146**, 435—437. Compare Moureu, Abstr., 1896, ii, 298; 1903, ii, 222; 1905, ii, 5; 1906, ii, 126, 442; Moureu and Biquard, Abstr., 1906, ii, 685).—The authors have conducted a series of experiments on the gases evolved from thermal springs, and from the results have calculated the total gaseous output of the spring, and the percentage of rare gases and of helium. The volume of gas evolved varies from 4891 to 560,640 litres per annum.; the proportion of rare gases varies from 1·24 to 6·39 per cent., and of helium, from 0·097 to 5·34 per cent.; the Bourbon-Lancy spring evolves annually 16,644 litres of rare gases, of which 10,074 litres are helium.

In conclusion, the authors draw attention to the close connexion existing between the results obtained by them on the rare gases from thermal waters, all more or less radioactive, and those obtained by Sir W. Ramsay and Cameron (Trans., 1907, **91**, 1266) on the chemical properties of radium emanation. M. A. W.

Solubility of Potassium Chloride in Aqueous Pyridine at 10°. JOHANNES SCHROEDER (*J. pr. Chem.*, 1908, [ii], **77**, 267—268. Compare Abstr., 1905, ii, 306).—Potassium chloride is not appreciably soluble in anhydrous pyridine, but dissolves in aqueous pyridine, the solubility increasing with the proportion of the water. The results of two series of determinations are given in tables. More complicated phenomena are observed at higher temperatures and with other salts; two layers are formed the composition of which is readily affected by changes of temperature. G. Y.

Electrochemical Behaviour of Silver and its Oxides. ROBERT LUTHER and F. POKORNÝ (*Zeitsch. anorg. Chem.*, 1908, **57**, 290—310). —When silver is oxidised at the anode in alkaline solution (normal sodium hydroxide) with small current-density, silver oxide, Ag_2O, is at first formed quantitatively and reversibly; on further oxidation, it is changed quantitatively and reversibly to a higher oxide, AgO. The change $Ag \longrightarrow Ag_2O$ takes place at + 1·172 volts (taking the hydrogen electrode as zero), the change $Ag_2O \longrightarrow AgO$ at + 1·40 volts, both at 25°, and no higher peroxide could be obtained in alkaline solution.

Wöhler (1868) has described the preparation of a silver peroxide by electrolytic oxidation of a silver anode in sulphuric acid, and Mulder (Abstr., 1897, ii, 551, &c) has described a "peroxynitrate" and other salts of silver prepared by electrolysis of neutral solutions of silver salts. By electrolytic reduction experiments, the authors now show that Wöhler's peroxide and Mulder's salts consist essentially of the peroxide, Ag_2O_3 (in the latter case with occluded or adsorbed silver salts); in alkaline solution, the change $Ag_2O_3 \longrightarrow AgO$ takes place at + 1·57 volts.

In acid solution, the compound Ag_2O_3 is decomposed directly into silver on electrolytic reduction, and, conversely, silver can be oxidised directly to Ag_2O_3.

From the potential of the electrode Ag/Ag_2O in sodium hydroxide (1·172 volts), the *E.M.F.* of the hydrogen–oxygen cell is calculated at 1·221 volts, in fair agreement with the value, 1·217 volts, recently obtained by Lewis (Abstr., 1906, ii, 262) by a less direct method.

G. S.

Alloys of Calcium with Zinc, Cadmium, Aluminium, Thallium, Lead, Tin, Bismuth, Antimony, and Copper. L. Dońskі (*Zeitsch. anorg. Chem.*, 1908, **57**, 185—219).—From an investigation of these alloys by Tammann's method of thermal analysis, controlled by microscopic observations, evidence has been obtained of the existence of the following compounds: $CaZn_{10}$, $CaZn_4$, Ca_2Zn_3, CaZn(?), Ca_4Zn; $CaCd_3$, CaCd, Ca_3Cd_2(?); $CaAl_3$; $CaTl_3$, CaTl(?); $CaPb_3$, $CaSn_3$. In only two cases does the composition correspond with the ordinary salt valencies, and the frequent occurrence of the formula CaM_3 is remarkable.

The experiments were greatly interfered with by oxidation of the calcium, and in many cases it was not found possible to investigate alloys rich in the latter metal.

Zinc–Calcium Alloys.—The freezing-point curve shows two maxima at 717° and 5·7% calcium and 688° and 29% of calcium, corresponding with the compounds $CaZn_{10}$ and Ca_2Zn_3 respectively, a break at 680° and 12·8% calcium, corresponding with the compound $CaZn_4$, which possibly melts without decomposition, and two eutectic points at 635° and 17% and 410° and 57% of calcium respectively. Between 29% and 56% of calcium, the compound Ca_2Zn_3 reacts with the fused mass at 431° to form a fourth compound, the composition of which could not be accurately determined, but may be CaZn. At 385°, between 52% and 84% of calcium, a fifth compound, Ca_4Zn, is produced by reaction of the compound of unknown composition with calcium.

Alloys containing up to 6% of calcium are rather harder than zinc, and are fairly stable in air and towards water, but with increasing proportion of calcium they darken in the air and act more vigorously on water. The brittleness increases up to 30% of calcium, and then diminishes.

Cadmium–Calcium Alloys.—The freezing-point curve of these metals does not show any maxima, but there are two eutectic points at 319° and 1% of calcium (components calcium and $CaCd_3$) and 415° and 71% calcium (components $CaCd_3$ and mixed crystals rich in calcium). Between 12% and 64% of calcium, the alloy forms two layers which react at 685° with formation of the compound $CaCd$; the latter has a transition point at 635°. At 615°, the compound $CaCd$ reacts with the fused mass rich in cadmium to form a second compound, $CaCd_3$. A further break in the cooling curve at 510° appears to indicate a reaction between $CaCd$ and the fused mass to form a third compound, the formula of which may be Ca_2Cd_3.

Alloys containing up to 10% of calcium are stable in the air, and scarcely act on water; beyond that point, the action on water increases with increase in the proportion of calcium. The brittleness increases rapidly between 10% and 40% of calcium, and beyond that point diminishes.

Aluminium–Calcium Alloys.—In this case, special precautions, which are described in detail, had to be employed to diminish oxidation. The freezing-point curve shows two eutectic points at 610° and 8·1% (components aluminium and $CaAl_3$) and 550° and 75% (components calcium and $CaAl_3$) of calcium respectively. Between 16% and 43% of calcium, the alloys separate into two liquid layers, which react at 692° to form the compound $CaAl_3$.

Alloys containing 0—8% of calcium are the colour of aluminium, and somewhat harder than that metal. Those containing a moderate amount of calcium are brittle and porous, and those rich in the latter metal are less brittle and are unstable in the air.

Thallium–Calcium Alloys.—Only alloys containing up to 15% of calcium could be investigated. The eutectic temperature lies about 6° higher than the melting point of thallium, from which the conclusion is drawn that mixed crystals rich in calcium are present; at the eutectic temperature, these are in equilibrium with the compound $CaTl_3$ and the fused mass. Between 6% and 16% of calcium, the compound $CaTl$ (needles) separates; at 524° this compound reacts with the fused mass to form $CaTl_3$ (bluish crystals), which separate primarily from about 0·5—6% of calcium.

The alloys are harder than thallium, brittle, and oxidise rapidly in the air. Those containing more than 6% of calcium do not decompose water at the ordinary temperature.

Lead–Calcium Alloys.—Only alloys up to 12% of calcium were examined. The freezing-point curve rises steeply from the melting point of lead to a maximum at 648° and 6% of calcium, corresponding with the compound $CaPb_3$, and then falls to a eutectic point at 625° and 9·7% of calcium.

Alloys containing up to 4% of calcium are harder than lead and not brittle; those containing a higher proportion of calcium are brittle. Alloys containing up to 6% of calcium are not markedly decomposed even by hot water.

Tin–Calcium Alloys.—Only alloys up to 18% of calcium were examined. The freezing-point curve rises steeply from the melting point of tin to a maximum at 623° and 10·1% of calcium, corresponding with the compound $CaSn_3$, and then falls to a eutectic point at 603° and 14·9% of calcium.

Alloys containing up to 4% of calcium are harder than tin and fairly tough; with further increase of calcium they become brittle. Those containing 2% of calcium are acted on by cold water.

Calcium–Bismuth Alloys.—Only alloys up to 10% of calcium could be investigated. The freezing point of bismuth is lowered about 5° by the addition of calcium; the eutectic mixture contains much less than 1% of the latter metal. From the eutectic point, the freezing-point curve rises to 500° and 4·5% of calcium, and then runs horizontally as far as it could be followed. The metals form a compound (needles) the formula of which could not be determined; it decomposes rapidly in moist air, and even in a vacuum over sulphuric acid.

Antimony–Calcium Alloys.—Only alloys up to 9% of calcium were investigated. The freezing point of antimony is lowered to 585° by the addition of calcium, the eutectic mixture containing 8% of the latter metal.

The alloys containing a small proportion of calcium are less brittle than antimony; the alloy containing 9% of calcium is brittle and porous. Those containing up to 6% of calcium are not acted on even by hot water.

Copper–Calcium Alloys.—On account of the high melting point of copper, these alloys could not be investigated satisfactorily. The melting point of copper is lowered 74° by the addition of 5% of calcium.

The alloy containing 1% of calcium is acted on by cold water.

G. S.

Preparation of Dry Calcium Hypochlorite. Chemische Fabrik Griesheim-Elektron (D.R.-P. 188524).—Calcium hypochlorite in a dry, stable condition can be obtained by saturating milk of lime with chlorine, filtering the solution of hypochlorite, and evaporating this down as rapidly as possible under reduced pressure.

Crystalline calcium hypochlorite is precipitated in the concentrated solution, and thus freed from calcium chloride. As the instability of the crystalline salt is due to the presence of water, this is removed by drying the compound in a vacuum until all the moisture and a portion of the water of crystallisation has been removed. The final product does not deliquesce in air, owing to its freedom from calcium chloride; it dissolves in water to a clear solution, and on treatment with hydrochloric acid evolves 80% to 90% of its weight of chlorine. G. T. M.

Monoxides and Monosulphides of the Elements of the Second Group of the Periodic System. Jakob Beckenkamp (*Zeitsch. Kryst. Min.*, 1908, **44**, 239—263).—A discussion of the dimorphic relations and the crystalline structure of the oxides and sulphides of glucinum, magnesium, calcium, zinc, &c., many of which crystallise in both the cubic and the rhombohedral systems with very nearly the same angles. L. J. S.

Mixtures of Zinc Sulphide with Other Sulphides. K. FRIEDRICH [with P. SCHOEN] (*Metallurgie*, 1908, **5**, 114—128).—Mixtures of zinc sulphide with other metallic sulphides were submitted to thermal and microscopic examination.

Pure zinc sulphide appears to melt at about 1660°. Mixtures with lead sulphide show a eutectic point at 1045° and 6% ZnS; there is no indication of the formation of a double sulphide or of mixed crystals. The eutectic structure is well marked in the solidified mixtures. Mixtures of cuprous sulphide with zinc sulphide, on the other hand, do not show any eutectic structure, and only a single branch of the freezing-point curve could be observed, the eutectic point, if present, lying close to the freezing point of cuprous sulphide.

Mixtures of the sulphides of silver and zinc form a eutectic containing 3% ZnS and solidifying at 800°. Zinc sulphide and ferrous sulphide also form an eutectic containing 5% ZnS and solidifying at about 1175°.

Zinc sulphide is somewhat volatile at high temperatures.

C. H. D.

Atomic Weight of Lead. I. Analysis of Lead Chloride. GREGORY P. BAXTER and JOHN HUNT WILSON (*Zeitsch. anorg. Chem.*, 1908, **57**, 174—184; *J. Amer. Chem. Soc.*, 1908, **30**, 187—195).—The amount of silver (in the form of nitrate) required for the complete precipitation of a known weight of lead chloride was determined, and the weight of silver chloride produced was also estimated.

Two samples of the chloride were prepared by different methods and crystallised several times in platinum vessels. When, however, the samples were finally heated in a current of hydrogen chloride, they darkened a little, and, on dissolving in water, left a dark residue, showing that some impurity was present. This difficulty is ascribed to a reaction between the salt and filter paper. A sample which remained colourless on heating and formed a clear solution with water was finally obtained by repeated crystallisation in platinum from solutions containing excess of hydrochloric acid. The pure chloride was melted in a stream of dry hydrogen chloride in a platinum vessel before weighing; the precautions taken are fully described.

The determination of the ratios $PbCl_2 : 2Ag$ (with the help of the nephelometer) and $PbCl_2 : 2AgCl$ were carried out as described in previous papers. As a mean of nine concordant experiments from the ratio $PbCl_2 : 2Ag$, the value $Pb = 207·188$ was obtained, and from six determinations of the ratio $PbCl_2 : 2AgCl$ the value 207·193. The most probable value is the mean of the two series, $Pb = 207·190$ [$Ag = 107·93$; $Cl = 35·473$].

G. S.

The Sulphides of Lead, Copper, Silver, and Iron. K. FRIEDRICH [with P. SCHOEN] (*Metallurgie*, 1908, **5**, 23—27, 50—58. Compare Abstr., 1907, ii, 687, 951).—The experimental difficulties encountered in determining the freezing point of metallic sulphides and mixtures of sulphides are discussed. By examining mixtures containing both more and less sulphur than is required to form the pure sulphide, fairly accurate values for the freezing point of the latter may be obtained.

The most probable values are: PbS, 1120°; Cu_2S, 1135°; As_2S, 812°; FeS, 1171°; in each case with an accuracy of ± 10° only.

Solidification takes place in all these cases over an interval of temperature, which, however, is possibly due merely to the low conductivity of the mass for heat and to the low velocity of crystallisation.

When a further quantity of sulphur is added, the freezing point of lead, silver, and iron sulphides is raised, and that of cuprous sulphide is depressed. C. H. D.

Electrolytic Extraction of Copper from its Ores. LUCIEN JUMAN (D.R.-P. 189643 and 189974).—The roasted copper ores, when treated with an ammoniacal solution of ammonium sulphite or sulphate, furnish a solution containing 7% of the metal; this solution, when freed from uncombined ammonia by evaporation, is treated with sulphur dioxide, whereby a precipitate of cuprosocupric sulphite ($Cu_2SO_3,CuSO_3$) is obtained, which is dissolved in an ammoniacal solution of ammonium sulphite or sulphate, and the metal precipitated by electrolysis with 0·5 ampere per sq. decimetre and 0·3 to 0·4 volt. The ammonia and ammonium salts can be again utilised in subsequent extractions of the roasted ore. By treating ammoniacal solutions of copper with sulphurous acid, or a normal or hydrogen sulphite, a precipitate of cuprous sulphite, cuprosocupric sulphite, or copper ammonium sulphite, or a mixture of these three salts is obtained. The solution is used for the extraction of more copper ores, and the precipitate is treated with an acid, such as sulphuric acid, which only gives rise to a cupric salt, so that a portion of the copper is precipitated, $Cu_2SO_3 + H_2SO_4 = Cu + CuSO_4 + SO_2 + H_2O$, and then subjected to electrolytic refining. G. T. M.

Conditions of Formation of Natural Copper Carbonates. FEDERICO MILLOSEVICH (*Atti R. Accad. Lincei*, 1907, [v], **17**, i, 82—85. Compare *Rend. Accad. Lincei*, 1906, [v], **15**, ii, 732).—From the results of experiments in which carbon dioxide was passed through copper sulphate solution placed in a tall cylinder and containing powdered marble in suspension, the author draws the following conclusions: (1) The necessary condition for the formation of the less basic of the two natural copper carbonates, namely, azurite, is the presence of calcium carbonate in large excess compared with the copper sulphate. (2) The presence of carbon dioxide, which dissolves the calcium carbonate, accelerates the formation of both malachite and azurite, and is possibly indispensable for the formation of the latter mineral, since only by its aid can a sufficiently large amount of calcium carbonate be brought into solution. T. H. P.

Determination of Atomic Weight of Europium. GUSTAV JANTSCH (*Compt. rend.*, 1908, **146**, 473—475).—Owing to the discrepancies existing between the values for the atomic weight of europium (Demarçay, Eu = 151, Abstr., 1900, ii, 481; Urbain and Lacombe, Eu = 151·99, Abstr., 1904, ii, 340, and Feit and Przibylla, Eu = 152·57, Abstr., 1906, ii, 745), the author has, at Urbain's suggestion, undertaken a redetermination of the constant. The method employed was the one used by Urbain and Lacombe (*loc. cit.*), and consisted in preparing the octahydrated sulphate from a nitric acid solution of the pure oxide, and weighing the anhydrous sulphate and the oxide obtained on ignition of the same. The purity of the oxide used was tested by photographing its spectrum, obtained by the electric arc (Griner and Urbain, this vol., ii, 108), on the same plate as the similarly obtained spectra of gadolinium and samarium; the only lines common to the three spectra were those of iron, silicon, and magnesium, due to traces of these elements as impurities in the carbon electrodes. The mean value of four determinations gives Eu = 152·03 with an error of ± 0·02 when O = 16, H = 1·008, S = 32·06.

M. A. W.

Fluorides of Gadolinium, Neodymium, and Praseodymium. JOAN POPOVICI (*Ber.*, 1908, **41**, 634—635).—*Gadolinium fluoride*, GdF_3, is obtained as a white, gelatinous precipitate when a solution of the sulphate is mixed with concentrated hydrofluoric acid. The precipitate becomes granular when heated on the water-bath; it is insoluble in water, but somewhat soluble in hot hydrofluoric acid. Gelatinous precipitates of the fluorides of neodymium, NdF_3, and praseodymium are formed when concentrated hydrofluoric acid is added to solutions of the nitrates. When warmed, the neodymium precipitate forms a pale lilac-coloured, crystalline powder, and the praseodymium fluoride a mass of yellow, glistening crystals.

J. J. S.

Lutecium and Neoytterbium. GEORGES URBAIN (*Compt. rend.*, 1908, **146**, 406—408).—In a previous communication (Abstr., 1907, ii, 956), the author has described the resolution of Marignac's ytterbium into the two elements lutecium and neoytterbium, which were characterised by their spark spectra; in the present paper, the results of the atomic weight determinations are recorded. The crude ytterbium was isolated from the xenotime earths by first eliminating the earths of the cerium, gadolinium, terbium, dysprosium, and holmium group by fractional crystallisation of the ethyl sulphates; the mother liquors, which contained the yttrium, erbium, thulium, and ytterbiums, were then submitted to repeated fractional crystallisations of the nitrates (Abstr., 1907, ii, 956), involving in all 15,000 successive crystallisations. The atomic weight of the ytterbiums, determined by analysis of the octahydrated sulphates of sixteen successive fractions, varied from 170·66 in the first fractions to 174·04 in the latter fractions. From the ytterbium sulphate, corresponding with atomic weight of 173·5, the base was fractionally precipitated by dilute sodium hydroxide, and each fraction converted into the sulphate; the atomic weight of the element yielding the weaker base (lutecium) was found to be 173·82, and that of the stronger (neoytterbium) 171·70.

The magnetic susceptibilities of the oxides of the two elements were determined by means of Curie and Chéneveau's magnetic balance; neoytterbia is much more para-magnetic than lutecia, the ratio between the two values being represented by the fraction 53/13.

In conclusion, the author claims priority against Auer von Welsbach [*Sitzungsber. K. Akad. Wiss. Wien.* (*Math. Natur. Klasse*), 1907, 468] on the ground that the two elements *aldebaranium* and *cassiopeïum*, isolated by him from ytterbium, are identical with lutecium and neo-ytterbium respectively. M. A. W.

An Isomeric Modification of Hydrated Hypovanadic Acid. GUSTAVE GAIN (*Compt. rend.*, 1907, **146**, 403—405).—Hydrated hypovanadic acid, $V_2O_4,2H_2O$ (Abstr., 1907, ii, 32), when kept out of contact with the moisture of the air, loses its red colour and changes into an olive-green isomeric form. Each isomeride loses H_2O at 140—150°, forming the bluish-black monohydrate, V_2O_4,H_2O, or when heated in hydrogen at 200—250° is converted into the black tetroxide, V_2O_4. The red hydrated hypovanadic acid dissolves in sulphuric acid to form an azure-blue solution containing the sulphate, $V_2O_4,2SO_3$; the green isomeride, under similar conditions, gives a green solution, the heats of solution in the two cases being 12·62 Cal. and 10·89 Cal. respectively, and each solution, on neutralisation with potassium hydroxide, becomes colourless. The heat of neutralisation of the blue solution is 16·92 Cal., and that of the green solution 18·56 Cal. It follows therefore that the loss of energy involved in the change from the unstable, red modification of hydrated hypovanadic acid to the stable, green isomeride is equivalent to 1·64 Cal. M. A. W.

Hardness of Aluminium Zinc Alloys. A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 95—100. Compare this vol., ii, 294).—Here, as in the case of tin and lead, the close relation existing between the structure and hardness of an alloy is very evident from the resemblance between the curves representing the relation between the composition of an alloy and its solidifying point and hardness respectively. The hardest alloy is one containing 30% zinc, which very much resembles the alloy of composition 72% aluminium, 24% zinc, 4% copper. The alloys containing 20—25% of zinc have a strong tendency to combine with iron, forming probably a definite chemical compound with great development of heat. The composition and limit of elasticity curve does not altogether correspond with the other curves, the variation of elasticity depending chiefly on the formation of solid solutions, but the hardest alloy has also the highest limit of elasticity. Z. K.

Alloys of Aluminium with Copper, Iron, Nickel, Cobalt, Lead, and Cadmium. ALFRED G. C. GWYER (*Zeitsch. anorg. Chem.*, 1908, **57**, 113—153).—From an investigation of these alloys by Tammann's method of thermal analysis, controlled by microscopic observations, evidence has been obtained of the existence of the following compounds: $CuAl_2$, $CuAl$, Cu_3Al; $FeAl_3$; $NiAl_3$, $NiAl_2$, $NiAl$; Co_3Al_{13}, Co_2Al_5, $CoAl$. Lead and cadmium do not enter into chemical combination with aluminium.

Most of the cooling curves were taken in an atmosphere of nitrogen in order to avoid oxidation.

Copper–Aluminium Alloys. (Compare Campbell, Abstr., 1904, ii, 820; Guillet, Abstr., 1905, ii, 712; Carpenter and Edwards, Eighth

Rep. Alloys Research Committee, 1907).—The freezing-point curve of these alloys shows a maximum at 1050° and 87·6% copper, corresponding with the compound Cu_3Al, two breaks at 625° and 56% and at 590° and 45% of copper respectively, a minimum at 88·5% of copper, and a eutectic point at 545° and 32·5% of copper, the components of the mixture being the compound $CuAl_2$ and mixed crystals containing 4% of copper. Three series of mixed crystals contain 0—4%, 71—88·5%, and 91·5—100% of copper respectively. From 88·5—91·5% of copper, the alloys consist of the two saturated mixed crystals, but, although the curve shows a minimum at the point, there is no true eutectic. At 625°, the saturated mixed crystal containing 71% of copper reacts with the fused mass to form the compound CuAl; at 590°, the latter reacts with the fused mass containing 44% of copper to form a third compound, $CuAl_2$.

The work of Guillet (*loc. cit.*) is adversely criticised, and the author's results differ from those of Carpenter and Edwards (*loc. cit.*), inasmuch as the latter observers suggest the formation of a compound Cu_4Al, but did not detect the well-defined compound CuAl.

Iron–Aluminium Alloys. (Compare Guillet, Abstr., 1902, ii, 21; Roberts-Austen, *Engineering*, 1895, 59, 744).—The freezing-point curve falls fairly rapidly from 100—50% of iron, shows a distinct break at the latter point, falls slowly from 50—30% of iron, and then rapidly to the melting point of aluminium. Two series of mixed crystals contain 40—48% and 66—100% of iron respectively; the end member of the first series may be the compound $FeAl_3$ (40·7% of iron). Alloys containing 60—65% of iron show eutectic breaks in the cooling curve at 1087°, but the breaks occur at higher temperatures from 50—57·5% of aluminium; alloys containing 52—65% contain a eutectic of the same structure, but the latter appears to differ in structure from the eutectic in 50% iron. Several points in the behaviour of alloys containing 48—66% iron remain unexplained.

Only alloys containing more than 70% of iron are magnetic, and the temperature at which the magnetic permeability disappears on heating is gradually lowered as the proportion of aluminium increases.

Nickel–Aluminium Alloys.—These metals combine almost explosively when heated at 1300°. The cooling curve was taken in magnesia tubes. The freezing-point curve shows a maximum at 1628° and 68·4% of nickel, corresponding with the compound NiAl, two breaks at 830° and 27% and 1130° and 42% of nickel respectively, a minimum at 87% nickel, and a eutectic point (Al—$NiAl_3$) at 630° and 6% of nickel. Two series of mixed crystals contain 68·4—81% and 87·5—100% of nickel respectively at 1370°, but the limits of saturation are considerably displaced on change of temperature. For example, the alloy containing 85% of nickel becomes homogeneous on prolonged heating at 1050°. The explanation of the minimum in the curve is the same as in the case of the iron–aluminium alloys, to which these alloys bear a close resemblance. At 1130°, NiAl reacts with the fused mass to form the compound $NiAl_2$, and at 830° the latter reacts with the fused mass to form a third compound, $NiAl_3$ (long needles).

Only alloys containing more than 85% of nickel are magnetic, and the magnetic power falls off rapidly with decrease in the proportion of nickel. The temperature at which the magnetic permeability disappears is greatly lowered by the presence of aluminium.

Cobalt-Aluminium Alloys.—The freezing-point curve of these alloys shows a maximum of 1628° and 68·5% of cobalt, corresponding with the compound CoAl, two breaks at 1165° and 38% and 940° and 20% of cobalt, and a minimum at 90% of cobalt. Two series of mixed crystals contain 68·5—80% and 90·5—100% of cobalt respectively. Alloys containing 82—90% of cobalt did not become homogeneous on heating for three hours at 1250—1270°. At 1165°, the compound CoAl reacts with the fused mass to form the compound Co_2Al_5; at 940°, the latter reacts with the fused mass to form a third compound, Co_3Al_{13}.

Only alloys containing more than 68·5% of cobalt are magnetic, and the temperature at which the magnetic power disappears on heating is progressively lowered by the addition of aluminium.

Aluminium-Lead Alloys. (Compare Heycock and Neville, Trans., 1892, **61**, 888).—These metals are not miscible in the fused state. Alloys containing up to 5% of lead solidify without separating into two layers, forming a sort of emulsion.

Aluminium-Cadmium Alloys.—These metals are also not miscible in the fused state. Separation into two layers only takes place when the alloy contains more than 10% of cadmium.

The paper is illustrated by twenty-two photomicrographs. G. S.

Preparation of Hydrosols of Metallic Hydroxides from Hydrogels. ARTHUR MÜLLER (*Zeitsch. anorg. Chem.*, 1908, **57**, 311—322).—Colloidal solutions of certain metallic hydroxides have been prepared by dissolving the precipitated washed hydroxides (hydrogels) in dilute mineral acids, or in strongly hydrolysed solutions of the corresponding metallic salts. The hydroxide is shaken up in a flask with water, and the acid or salt solution added in successive portions until a clear solution is obtained, the mixture being well boiled after each addition of electrolyte.

The preparation, by the above method, and the properties of colloidal solutions of the hydroxides of aluminium, thorium, yttrium, cobalt, and iron are described. The solutions show the usual properties of colloidal solutions, the particles being positively charged.

There is no definite relation between the quantity of electrolyte used and the amount of hydroxide brought into solution, the amount of electrolyte required depending on the age and previous treatment of the colloidal hydroxide. G. S.

The Decarburisation of Iron. FRIEDRICH WÜST (*Metallurgie*, 1908, **5**, 7—12).—In the conversion of cast-iron into malleable-iron by heating in contact with iron oxide, the removal of carbon only begins after a decomposition of the carbide (cementite) into ferrite and carbon (temper-carbon) has taken place. By experiments with a cast-iron containing 4·15% of carbon, 3·45% of which was in the form of temper-carbon, it was found to be immaterial whether the iron was in contact with the ferric oxide or not. By exhausting the apparatus and analysing the gases formed from time to time, it was found that the oxidising agent is oxygen, evolved by the ferric oxide at 1000° and upwards. This oxygen diffuses into the iron, forming carbon dioxide, which then diffuses further, being converted into carbon monoxide by the temper-carbon in the interior. This carbon monoxide is reoxidised by the ferric oxide, ferrous oxide and metallic iron being produced. Should the quantity of iron oxide be insufficient, the pressure of carbon dioxide may rise to such an extent that the process is reversed, the outer layers of iron being carburised by the decomposition of the carbon dioxide.

This explanation of the process is confirmed by the microscopic examination of the outer and inner layers of the mass of iron.

C. H. D.

Influence of Phosphorus on the System Iron–Carbon. FRIEDRICH WÜST (*Metallurgie*, 1908, **5**, 73—87).—The temperature at which saturated iron–carbon alloys begin to solidify is lowered by the addition of phosphorus, 1% of phosphorus causing a depression of 27°. When the proportion of phosphorus exceeds 6·7%, the freezing point again rises. The ternary eutectic melts at 950°, and contains 6·7% P, 2·0% C, and 91·3% Fe. The eutectic disappears at a phosphorus content of 15%, corresponding with the phosphide Fe_3P. Alloys containing between 6·7% and 15% of phosphorus show crystals of the phosphide.

The solubility of carbon in iron is reduced by the addition of phosphorus, but the temperature of formation of the eutectoid perlite is not influenced by the presence of the phosphide.

The paper is illustrated with photomicrographs, in some of which the oxidation-tints of the constituents are reproduced by colour-photography. C. H. D.

Different Colours of Ferric Oxide, an Effect of the Size of the Grains. LOTHAR WÖHLER and C. CONDREA (*Zeitsch. angew. Chem.*, 1908, **21**, 481—486).—A study of the conditions of the formation of differently coloured ferric oxides. The violet substance, formed by heating yellowish-red ferric oxide with sodium chloride in an iron crucible over the blowpipe flame, is pure ferric oxide. It is prepared also by heating yellow ferric oxide with other salts, such as calcium chloride, sodium sulphate, potassium chloride, and borax. The shade varies from brown to violet with the temperature and with the amount and nature of the salt added, the deepest shades being obtained when the added salt is not less than 6% of the weight of the ferric oxide. The amount of salt which must be added diminishes as the temperature is raised; the reaction does not take place below the m. p. of the salt. The rate of cooling is without influence on the shade, at least with small quantities. At low temperatures, the presence of water is found to affect the shade in the same manner as that of salts at high temperatures. These results point to the size of the grains as determining the colour of the ferric oxide. In agreement with this, brown or violet ferric oxide is converted into the yellowish-red variety by alternate grinding and washing. G. Y.

Ferronitrososulphides. Livio Cambi (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 202—207. Compare this vol., ii, 41).—The author discusses previous work on the constitution of Roussin's salts, and describes further experiments bearing on this question.

An excess of silver sulphate together with dilute sulphuric acid was treated with potassium ferronitrososulphide in an atmosphere of carbon dioxide. Subsequent titration with permanganate showed that, in this reaction, the iron is reduced quantitatively to the ferrous state. In some cases, when the temperature and acidity are chosen so as to cause the reaction to proceed very rapidly, the iron may undergo only partial reduction, a large proportion of the nitroso-groups not being oxidised, but yielding hyponitrous acid. The reducing action of the nitroso-groups here manifest is demonstrated even more clearly by treating excess of ferric sulphate and silver sulphate in presence of sulphuric acid with potassium ferronitrososulphide; in this reaction, 7 mols. of nitric oxide and 7 atoms of ferrous iron are obtained per mol. of ferronitrososulphide.

The action of potassium ferronitrososulphide on silver sulphate yields silver nitrate and silver hyponitrite, the gas evolved under the action of sulphuric acid consisting of nitric oxide and nitrous oxide; the latter owes its formation to the deficit of ferric iron. The production of 7 mols. of nitric oxide per mol. of ferronitrososulphide is hence necessarily connected with the formation of seven ferrous ions. The reaction in presence of ferric salt may be represented by the equation: $[Fe_4S_3''(NO)_7]' + 3Fe^{\cdots} = 7Fe^{\cdot\cdot} + 7NO + 3S''$. Seven mols. of nitric oxide are also liberated from potassium nitrososulphide by the action of copper sulphate, which acts as an oxidising agent, and passes into the cuprous form.

These results lead to the conclusion that Roussin's salts do not contain the residue of hyponitrous acid, $(ON\colon NO)''$. These salts contain a univalent group, NO′, capable of acting in two ways: firstly, giving hyponitrous acid, and, secondly, of yielding nitric oxide under the action of various oxidising agents. T. H. P.

Hydrolysis of Ferric Chloride. Effect of the Valency of the Negative Ions. G. Malfitano and Leopold Michel (*Compt. rend.*, 1908, **146**, 338—341. Compare this vol., ii, 111).—It is known that the precipitation of ferric colloids by anions diminishes as the valency of the latter increases. It is now shown that the anions act according to the same rule in preventing the formation of colloid. The authors have measured the increase in the conductivity at 50° of *N*/150 solutions of ferric chloride containing nitric, oxalic, hydrochloric, sulphuric, arsenic, and phosphoric acids at concentrations *N*/1000, *N*/250, and *N*/100 as a function of the time, and have illustrated the results by curves.

The activity of the acids in retarding the progress of the irreversible hydrolysis (indicated by the increase in conductivity with the time) is shown to be partly dependent on their degree of ionisation, but the influence of the anion is shown by the difference in activity between equally ionised acids, such as hydrochloric and nitric acids, and particularly by the activity of oxalic acid, which is much higher than would be expected from its ionisation coefficient. As the concentration of the acids diminishes, the influence of the hydrogen ions becomes negligible, and that of the anions, when multivalent, preponderant, probably through the replacement of chlorine in ferric chloride and formation of less dissociable molecules.

Curves are given showing the increase with time of the conductivity of $N/150$ ferric chloride solutions containing varying quantities of phosphoric acid. The increase is least when the concentration of the acid is $N/250$; at lower concentrations, the hydrolysis and formation of colloid are only slackened, and at higher concentrations the formation of colloid is definitely prevented, the conductivity meanwhile increasing with time. This can only be explained by the quantity of free hydrogen chloride displaced by the phosphoric acid. The phenomenon becomes more evident at 100°; solutions of ferric chloride containing an equivalent of phosphoric acid, when heated at this temperature, give a white positive colloid containing iron and phosphoric acid, which tends to disappear on cooling the more easily the greater the concentration of the ferric chloride. The formation of the hydroxide colloid is prevented when the ratio Fe/PO_4 reaches the values 1/6000 at 18°, 1/200 at 50°, and 1/16 at 100°, increase in temperature and dilution affecting only the irreversible, not the reversible, hydrolysis. The authors conclude that the ferric ions become less apt to form complex ions, ($Fe[Fe(OH)_3]_n$), as the valency of the accompanying anions increases, and the micro-cells, conceived as complex ions of large dimensions (n being very great), protect the molecules of the hydroxide from the hydrochloric acid. Consequently, if these complex ions cannot be formed, the irreversible hydrolysis is impeded. E. H.

Thermal Dissociation of the Anhydrous Sulphates of Iron. GUSTAV KEPPELER and JEAN D'ANS (*Zeitsch. physikal. Chem.*, 1908, **62**, 89—118).—The authors have studied some problems bearing on the ferric oxide contact process for the manufacture of sulphuric acid (compare Lunge and Pollitt, Abstr., 1903, ii, 70; Lunge and Reinhardt, Abstr., 1904, ii, 724). The anhydrous sulphates investigated were ferric sulphate, basic ferric sulphate, $Fe_2O(SO_4)_2$, and ferrous sulphate; details of the preparation of these substances are given in the paper.

A current of air or nitrogen was passed through a tube containing the anhydrous sulphate and heated to a definite temperature; the proportion of sulphur dioxide and sulphur trioxide in the issuing gas was then determined analytically.

The equilibrium between ferric sulphate and sulphur trioxide is represented as $Fe_2(SO_4)_3 \rightleftharpoons Fe_2O_3 + 3SO_3$. The change of the SO_3 tension with temperature in this system is given adequately between 500° and 700° by the formula $\log p = 11{\cdot}8626 - 44720/4{\cdot}584T$. In the gaseous phase, the equilibrium $2SO_3 \rightleftharpoons 2SO_2 + O_2$ is established, and the equilibrium constants found for this reaction are in good agreement with the values given by Bodenstein and Pohl (Abstr., 1905, ii, 581).

The tension of sulphur trioxide over basic ferric sulphate is greater than over normal ferric sulphate at the same temperature, and the former is accordingly regarded as a labile compound. It was observed that in the gaseous phase at the lower temperatures the expected equilibrium was not reached; in all cases too much sulphur dioxide was found.

The behaviour of ferrous sulphate is best represented by the equation $2FeSO_4 \rightleftharpoons (Fe_2O_3,SO_3) + SO_2$, the sulphate on the right hand side of this equation being the normal one. In the gaseous phase above ferrous sulphate at a high temperature there is a constant ratio between the partial pressures of sulphur dioxide and sulphur trioxide.

Indications were obtained that at 640° ferric oxide undergoes an allotropic change. It was at this temperature that Lunge and Reinhardt (*loc. cit.*) found a maximum yield of sulphur trioxide from gases containing 2·1% of the dioxide. At this temperature, also, the observed tension of sulphur trioxide is the same as that of ferric sulphate. Above 640°, the velocity of the catalytic combination of sulphur dioxide and oxygen is greater than the velocity of formation of ferric sulphate. J. C. P.

New Method for Determining the Tension of Sulphates. Lothar Wöhler, W. Plüddemann, and P. Wöhler (*Ber.*, 1908, **41**, 703—717).—This investigation was undertaken as the knowledge of the partial pressures of sulphur trioxide from sulphates is necessary for the interpretation of the contact process. The tension of the sulphates was determined by a statical method which had to satisfy the following conditions: (1) sulphur trioxide should not condense, (2) the gas ought not to come in contact with the mercury in the manometer, (3) the equilibrium $2SO_3 \rightleftharpoons 2SO_2 + O_2$ must be accomplished in the shortest possible time, (4) sufficient substance should be taken in order to carry out a series of determinations, and (5) no india-rubber connexions or greased cocks should be employed.

The apparatus consisted of a porcelain tube which contained the sulphate, placed in a platinum tube, on the top of which a piece of platinum gauze was placed, and then some spongy platinum. The tube, heated in a Heräus vertical tube furnace, is connected to a condenser, heated by steam, by means of a ground-joint smeared with deliquesced phosphoric oxide and sealed with mercury. The manometer is connected to the condenser by a T-piece through a tube containing sodium hydroxide and calcium chloride, the other end of the T-piece being connected to the pump.

The equilibrium pressure was determined by closing the tube, heated to the desired temperature, and allowing air into the evacuated apparatus at a known pressure, opening momentarily the connecting stopcock, and, if the pressure did not change, the equilibrium pressure was reached. With ferric sulphate, for example, at 599°, the pressure observed was 53·0 mm.; at 630° it was 102·5 mm. To ascertain whether ferric sulphate was decomposed direct into oxide and sulphur trioxide, the basic material, Fe_2O_3,SO_3, was heated, and the tension found at three different temperatures agreed with those found for $Fe_2O_3,3SO_3$, thus showing that a basic sulphate of iron is not formed and that there is no evidence for the formation of a solid solution of oxide and sulphate. In this way, it was found that aluminium and thorium sulphates also decompose directly to oxide. As the normal chromium and titanium sulphates could not be obtained, the water-free basic sulphates, $Cr_2O_3,2SO_3$, $2Cr_2O_3,3SO_3$, were prepared the first by heating in a stream of carbon dioxide to 280°, and the second by heating to 450—460° in a crucible. With the latter basic sulphate, the tensions observed are lower than with the more acid sulphate. A material of composition $7Cr_2O_3.2SO_3$ showed the same tensions as the sulphate $2Cr_2O_3.3SO_3$. Similar results were obtained with the basic titanium sulphates TiO_2,SO_3, $2TiO_2,SO_3$.

Copper sulphate is shown to form in addition to the normal sulphate, only the basic oxide, $2CuO,SO_3$. Cerium sulphate by heating loses oxygen and passes into cerous sulphate.

The method of calculating the partial pressure of sulphur trioxide from the total pressure is given, and the heat of dissociation of $Fe_2O_3,3SO_3$, $Al_2O_3.3SO_3$, $Cr_2O_3,2SO_3$, $ThO_2,2SO_3$, CuO,SO_3, and ZnO,SO_3 found to be 27, 17, 22, 21, 13, and 36 calories respectively.

A method has been devised for the quantitative separation of iron and zinc by means of their different tensions. At 680°, the tension for ferric sulphate is nearly 1 atmos., whereas for zinc sulphate it is only 6 mm., so that by heating the mixture of sulphates at that temperature until constant in weight, the ferric oxide remains mixed with the unchanged zinc sulphate. Other separations can be effected, but, in general, metals of similar chemical characteristics cannot be separated in this way, for example, iron and aluminium. W. R.

Metallic Silicates. I. Preparation of Metallic Silicates by Wet Methods. EDUARD JORDIS (*J. pr. Chem.*, 1908, [ii], 77, 226—237. Compare this vol., ii, 103).—A discussion of the conditions which must be observed in the study of the formation of silicates of the heavy metals in the wet way, and a criticism of Gröger's investigation of copper carbonate (Abstr., 1900, ii, 542). G. Y.

Metallic Silicates. II. Interactions of Sodium Silicate and Metallic Salt Solutions. EDUARD JORDIS AND W. HENNIS (*J. pr. Chem.*, 1908, [ii], 77, 238—261).—The reactions of copper sulphate, ferrous sulphate, and ferric chloride with sodium silicate in aqueous solution do not take place according to the equations which can be written for them. If the reagents are mixed in equivalent amounts, an acid liquid is obtained which contains silicic acid, in considerable amount from the ferric chloride reaction. The amount of the metal found in the filtrate varies independently of the reaction of the liquid, and is especially large with ferric chloride. In presence of much alkali, the metal dissolves together with silicic acid. If an excess of either reagent is added, the portion which passes into the filtrate increases with the excess from a minimum.

The course of the reaction is especially complicated in the case of ferric chloride. The acid filtrate requires considerable amounts of alkali for neutralisation, and thereafter combines with still larger amounts of alkali before becoming alkaline. This reaction is taken part in, not only by the precipitate, but also by dissolved substances.

The amount of alkali neutralised is approximately proportional to the total amount of silicic acid present. Precipitates of varying composition are obtained from the clear filtrate by addition of hydrochloric acid, by the action of heat, and on neutralisation. Permanent changes are produced by heating. In many cases the reaction, especially between the precipitate and the mother liquor, takes place slowly. The precipitates are soluble in acids only when freshly formed. Clear filtrates are obtained from the turbid reaction mixture only when a colloidal layer has been formed on the surface of the filter. Pure ferrous silicates are bluish-green, and on oxidation become yellow, passing through green or brown intermediate stages.

The copper silicates are blue or, when anhydrous, green; precipitates formed with an excess of copper sulphate are more or less green, in consequence of the formation of crystalline, basic copper sulphate.

The silicate precipitates remain unchanged when boiled with their mother liquors, whereas under the same conditions a partly oxidised ferrous hydroxide becomes black; this blackening, however, does not take place if the precipitate is ground with colloidal silica before being boiled.

Solutions of $Na_2Si_2O_5$ or $2NaHSiO_3$, which analytically are identical, react in the same manner as solutions of Na_2SiO_3. It is probable that they contain the ion Si_2O_5''. G. Y.

Freezing-point Curve of the Nickel Sulphides. K. BORNEMANN (*Metallurgie*, 1908, **5**, 13—19).—Mixtures containing from 0% to 31% sulphur were examined, mixtures richer in sulphur being unstable under atmospheric pressure. The components are completely miscible in the liquid state. The equilibrium diagram is complicated, five series of mixed crystals separating from the fused mass. The freezing-point curve, up to 31% sulphur, consists of five branches, with eutectic points at 21·4% and 30·6% sulphur and 644° and 812° respectively. The only compound capable of existence in contact with the melt is Ni_3S_2, melting at 787°. A number of transformations take place in the solid state, the existence of the compounds NiS, Ni_3S_4, and NiS_2 being proved by Tammann's method. All these dissociate below the melting point. The compound Ni_2S has no existence, mixtures of that composition having a eutectic structure. The existence of Ni_6S_5 is highly probable, but mixtures of this composition lose sulphur on fusion. The curves representing the thermal transformations in the solid state have been completely studied, there being a well-marked eutectoid point at 29·7% sulphur and 520°.

The results of the thermal analysis are fully confirmed by a comparative study of the density and microscopic structure of mixtures allowed to cool slowly and rapidly quenched. C. H. D.

The Constitution of Nickel Matte. K. BORNEMANN (*Metallurgie*, 1908, **5**, 61—68. Compare preceding abstract).—The thermal and microscopic examination of mixtures of ferrous sulphide with the stable nickel sulphide, Ni_3S_2, shows the existence of a compound $2FeS,Ni_3S_2$, which melts at 840° and dissociates considerably on fusion. The compound forms mixed crystals in all proportions with Ni_3S_2, but ferrous sulphide only dissolves it to a very small extent in the solid state. At lower temperatures, transformations occur which it has not been possible to determine accurately.

When the mixtures are prepared with a nickel sulphide of the composition Ni_2S, a more complicated thermal diagram is obtained. This compound, although incapable of separate existence, forms stable compounds with ferrous sulphide. The only compound which is stable in contact with the fused mass is $2FeS,Ni_2S$, which melts at 886°, but breaks up on cooling to 575° into FeS and $3FeS,2Ni_2S$. At a still lower temperature this compound combines with FeS to form $4FeS,Ni_2S$, but the change is not accompanied by development of heat, and could only be detected by microscopic examination and by determinations of density. C. H. D.

Molecular Weight of the Greyish-blue Hydrate of Chromic Chloride. I. Neutralisation of the Salt by Sodium Hydroxide. JULIUS SAND and F. GRAMMLING (*Zeitsch. physikal. Chem.*, 1908, **62**, 1—27. Compare Werner and Gubser, Abstr., 1901, ii, 453; Bjerrum, Abstr., 1907, ii, 554, 662).—If sodium hydroxide is gradually added to a solution of the greyish-blue chromic chloride, the colour assumes more and more a green tinge, but remains perfectly clear until 1 molecule of sodium hydroxide has been added for every atom of chromium present; further addition of the alkali produces an opalescence, and, finally, when two or more molecules of sodium hydroxide have been added for every atom of chromium, a precipitate is formed.

The gradual neutralisation of the greyish-blue salt by sodium hydroxide in the first stage, and the consequent removal of the hydrogen ions, have been followed by the electrochemical method already employed (Sand and Eisenlohr, Abstr., 1907, ii, 178). Two formulæ showing the relation between the *E.M.F.* of a hydrogen electrode immersed in a partly neutralised solution of the chloride and the amount of sodium hydroxide added are deduced; these are respectively based (1) on the supposition that the chromium ion is $Cr^{\cdot\cdot\cdot}$, and (2) on the supposition that it is $Cr_2^{\cdot\cdot\cdot\cdot\cdot\cdot}$. The experimental figures are in good agreement with the second formulæ, and the greyish-blue salt is accordingly formulated as $Cr_2(H_2O)_{12}Cl_6$, and it is regarded as probable that the two chromium atoms in this compound are connected with each other through an oxygen atom. The reaction which takes place on the first addition of sodium hydroxide is represented by the equation

$$Cr_2(H_2O)_{12}Cl_6 + 2NaOH = 2Cr[OH(H_2O)_x]Cl_2 + 2NaCl + (12 - 2x)H_2O.$$

At this stage of the neutralisation the concentration of the hydrogen ions will be determined by the hydrolytic equilibrium: $Cr_2^{\cdot\cdot\cdot\cdot\cdot\cdot} + 2H_2O \rightleftharpoons 2CrOH^{\cdot\cdot} + 2H^{\cdot}$.

The green chromic chloride, on the basis of similar electrochemical measurements, is found to be unimolecular. The addition of sodium hydroxide to a solution of this salt leads to simultaneous hydrolysis in two directions:

$$(1)\ CrCl_2^{\cdot} + H_2O \rightleftharpoons CrOH^{\cdot\cdot} + H^{\cdot} + 2Cl'.$$
$$(2)\ CrCl_2^{\cdot} + H_2O \rightleftharpoons CrO^{\cdot} + 2H^{\cdot} + 2Cl'.$$

J. C. P.

Molecular Weight of the Greyish-blue Hydrate of Chromic Chloride. II. Hydrolysis of the Salt by Potassium Iodide and Iodate. JULIUS SAND and F. GRAMMLING (*Zeitsch. physikal. Chem.*, 1908, **62**, 28—43. Compare preceding abstract).—The velocity with which solutions of the greyish-blue hydrate of chromic chloride liberate iodine from a mixture of potassium iodide and iodate has been determined, and from these measurements the proportion of hydrogen ions in solutions of the hydrate has been deduced (compare Sand and Eisenlohr, Abstr., 1907, ii, 179).

On the basis of the supposition that the hydrolytic equilibrium involved is $Cr_2^{\cdot\cdot\cdot\cdot\cdot\cdot}+2H_2O \rightleftharpoons 2CrOH^{\cdot}+2H^{\cdot}$, formulæ are deduced for the rate of liberation of iodine from the iodide-iodate mixture which are in good agreement with the experimental figures. On the other hand, there is no agreement between the experimental figures and the values of the velocity-coefficient based on the supposition that chromic chloride has the unimolecular formula $Cr(H_2O)_6Cl_3$. The evidence therefore goes to show that this formula must be doubled, and that the molecule of the greyish-blue hydrate contains two chromium atoms linked together. J. C. P.

Chromates. NICOLA PARRAVANO and A. PASTA (*Zeitsch. anorg. Chem.*, 1907, **57**, 240. Compare Abstr., 1907, i, 961).—A claim for priority against Briggs (this vol., ii, 113) with reference to the preparation of compounds of certain dichromates with pyridine.

G. S.

Sulphate of Tervalent Uranium. ARTHUR ROSENHEIM and HEINRICH LOEBEL (*Zeitsch. anorg. Chem.*, 1908, **57**, 234—239).—A solution of uranium trichloride, UCl_3 (Peligot, 1842), in a large excess of hydrochloric acid, was obtained by the electrolytic reduction of the trioxide, UO_3, dissolved in hydrochloric acid (D 1·12) in a special apparatus, in which a layer of mercury was used as the cathode. To complete the reduction, the solution had to be cooled to 0° towards the end of the experiment. In the presence of traces of dissolved mercury or of platinum, the reduction stops at quadrivalent uranium, probably because these substances facilitate the liberation of hydrogen.

The great majority of reagents, even water, decompose the acid solution of uranium trichloride with formation of quadrivalent uranium compounds, but when the solution is mixed with fairly concentrated sulphuric acid, both previously cooled to 0°, deep brown leaflets of the compound $UH(SO_4)_2$ separate. Before analysis, the crystals were washed with anhydrous acetic acid, but, owing to the difficulty of removing all the sulphuric acid, the formula of the compound is not regarded as being conclusively established.

G. S.

Hardness of Tin and Lead Alloys. A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 92—95).—Tin and lead do not form chemical compounds, but solid solutions are formed by tin in lead up to the composition 10—15% tin. As tin is added to lead, the hardness of the alloy increases until 40% tin is present, when it decreases, but at the composition 66% tin, the hardness attains a maximum. Since this point coincides with the eutectic point of the alloy, it confirms the view previously expressed that the hardness of alloys is very closely related to their structure. Z. K.

Stannichlorides of the Type $M_2'SnCl_6$, $M''SnCl_6$. III. Hydrolysis of Stannic Chloride. Eugen von Biron (*J. Russ. Phys. Chem. Soc.*, 1905, 37, 963—993. Compare Abstr., 1905, ii, 40).—The first products of the hydrolysis of stannic chloride are oxychlorides intermediate in nature between meta- and para-chlorostannic acids, and it is these oxychlorides which yield the colour reaction with stannous chloride before β-stannic acid has been formed either as a hydrosol in solution or as a precipitate. The latter occurs the more rapidly the more dilute the solution; at higher concentrations, however, β-stannic acid is not precipitated, but undergoes condensation, forming oxychlorides with a smaller proportion of chlorine, thus leaving more free hydrochloric acid in solution, and the quantity of the latter determined by measuring the electric conductivity of the solution is taken as a measure of the extent of hydrolysis of the stannic chloride (compare Foster, *Phys. Review*, 1899, 9, 41; Kowalewski, Abstr., 1900, ii, 256; Kohlrausch, Abstr., 1900, ii, 408; Van Bemmelen and Klobbie, Abstr., 1900, ii, 338). The increase in the initial electrical conductivity on dilution proceeds more rapidly than is the case for ordinary electrolytes, and the acidity of the solution, in spite of the fact that $SnCl_4$ itself is not an electrolyte and the analogy of $SnCl_4$ with $TiCl_4$ and $SiCl_4$ leads to the conclusion that it decomposes in water, thus: $SnCl_4 + (n+2)H_2O \rightleftharpoons SnO_2,nH_2O + 4HCl$, and side by side with this the following reaction probably also occurs: $SnCl_4 + mSnO_2,nH_2O = SnCl_4,mSnO_2,nH_2O$ or $SnCl_4 + mSnO_2,nH_2O = (m+1)[SnO_2,xHCl,yH_2O]$, but the main reaction, being instantaneous, is not applicable to the slow hydrolysis of stannic chloride. Although all aqueous solutions of stannic chloride are electrolytes when freshly prepared, only those solutions give the reaction with stannous chloride the electric conductivity of which changes with time. It is thus evident that the change in electric conductivity is a consequence of the formation of the derivatives of β-stannic acid, the β-oxychlorides of tin being formed by the gradual condensation of the stannic acid contained in the indefinite oxychlorides of tin termed α-oxychlorides, the hydrochloride thus disengaged causing a rise in the electric conductivity. The slow hydrolysis of stannic chloride may therefore be expressed thus:

$$\alpha\text{-}SnO_2,xHCl,yH_2O = \beta\text{-}SnO_2,zHCl,sH_2O.$$

In concentrated solutions, part of the stannic chloride decomposes, forming stannic acid, which with undecomposed chloride forms α-oxychlorides containing a high percentage of chlorine, which prevents the condensation of its constituent stannic acid, thus hindering the occurrence of slow hydrolysis. In such solutions, there is also present undecomposed stannic chloride either in the form of hydrates or as chlorostannic acid. If at the very commencement of a reaction hydrochloric acid is added to a dilute solution undergoing slow hydrolysis, the latter cannot proceed, since the condensation of stannic acid is prevented; when, however, the solution is too dilute, the α-oxychlorides contain too little chlorine, consequently, instead of forming β-oxychlorides, they are converted into β-stannic acid, which is precipitated in a more or less condensed form, depending on the time intervening between the preparation of the solution and the precipitation of the acid. Z. K.

Stannichlorides of the Type $M'SnCl_6$, $M''SnCl_6$. IV. Dissociation of Stannichlorides in Aqueous Solutions. EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 994—1036. Compare preceding abstract).—Sodium chloride retards the formation of β-oxychlorides in concentrated solutions of stannic chloride ; as the solutions are diluted, this effect becomes less, and in very dilute solutions (0·01 part $SnCl_4$ per litre) it considerably accelerates the separation of stannic acid. Probably in concentrated solutions it is the sodium stannichloride which exerts most influence, whereas in dilute solutions the free sodium chloride affects the rate of the reaction. Investigation of the electrical conductivity of such solutions confirms these results, and shows that, as the concentration of sodium chloride is increased, the change in specific conductivity, Δx, becomes less, and finally becomes constant. The same is true for magnesium chloride, but the action of cadmium chloride is quite different, its log.time-sp. conductivity curve being very similar to that for pure stannic chloride.

The following reasons lead to the conclusion that the metallic stannichlorides are only partly dissociated in solution : (1) the possibility of crystallising them from solutions containing an excess of tin chloride. (2) Δx varies in the same way in experiments with an excess of tin chloride as with an excess of sodium chloride, and, since the latter does not influence Δx merely as such, the variation of Δx must depend on the formation in the solution of a stannichloride. (3) The influence of sodium chloride on the slow hydrolysis of stannic chloride is 420 times as great as that on tin metachloride. (4) The addition of sodium chloride reduces the electrical conductivity to below that of a solution of sodium chloride, and this can, of course, only be due to the presence of a complex compound. (5) Δx continually diminishes with time in the case of pure stannic chloride, whereas in the presence of a metallic chloride it remains constant for considerable intervals, and, although the hydrolysis is of the same character with or without the metallic chloride, the stannichloride formed in the presence of the latter acts as a reserve for the continual supply of more ions for preserving equilibrium. (6) The impossibility of obtaining cadmium stannichloride agrees with its abnormal behaviour mentioned above. A large number of experiments with various stannichlorides (0·5 part per litre) shows that, except for zinc and cadmium, Δx is constant for ten days and does not depend on the degree of dissociation of the metallic chloride or on the initial conductivity of the solution, but the latter depends on the mobility of the cation. These and other experiments also point to the fact that Δx is a true measure of the degree of dissociation of the given stannichloride. In the case of the alkaline earths, in dilute solutions, Δx is practically identical for each, but, as the concentration of the free metallic chloride increases, Δx becomes least for calcium and highest for barium, this probably depending on the formation of hydrates of the metallic chlorides.

Thus, whilst the quantity of the chloride is small and the active mass of water large, the formation of these hydrates cannot influence the course of the reaction, and Δx therefore indicates the degree of dissociation of the stannichloride, but, when the concentration of the chloride is high, the formation of hydrates diminishes the active mass of water; Δx therefore diminishes, and the extent of this diminution will depend on the degree of hydration of the chloride. This is also observed, to a less extent, in the case of the other metals. Z. K.

Stannichlorides of the Type $M_2'SnCl_6$, $M''SnCl_6$. V. Partition of Stannic Chloride between Two Metallic Chlorides. EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1905, **37**, 1036—1063. Compare preceding abstract).—The conclusions arrived at in the preceding abstracts are confirmed by a spectrophotometric method. As stannic chloride is added to a solution of cobalt chloride, the absorption region of the latter spreads out towards the red end of the spectrum, and at the same time there is increasing absorption at the violet end. By thus investigating the absorption spectra of solutions of stannic chloride, cobalt chloride, and some other transparent chloride, it is possible to calculate the partition of the stannic chloride between the two metallic chlorides. Stannic chloride itself does not absorb light, and the absorption, which after a certain concentration of stannic chloride becomes constant, must thus be due to the formation in solution of cobalt stannichloride, which has a greater absorption-coefficient than cobalt chloride. The quantity of stannichloride in solutions in which it is appreciably dissociated can be calculated by a series of calculations by means of the formula $a = A(c - x) + A'x$ (c = quantity of $CoCl_2$, $x = CoSnCl_6$ formed, A' = fractional-coefficient of absorption of cobalt stannichloride, and A = similar coefficient for cobalt chloride; the values so obtained agreeing well with the experimental results). The equilibrium constant $k = C_cC_s/C_{cs}$ (C_c = concentration of cobalt chloride, C_s = concentration of tin chloride, and C_{cs} = concentration of cobalt stannichloride). Calculating in this way the values Co : M (M = any metal) in relation to the affinity of their chlorides for stannic chloride, and comparing them with the values $1/\Delta x$ for the corresponding metals, there is a striking similarity between the two constants. The following conclusions are also drawn: (1) the affinity constants, K, of the metallic chlorides for stannic chloride are comparable with the affinity of anhydrides for oxides. (2) In the first and second groups of the elements in the periodic system, K increases with increasing atomic weight in the even series and decreases in the odd series. (3) K is greater for those chlorides which have the greatest tendency to hydration. (4) The metallic chlorides which form complex anions have little affinity for stannic chloride. Various theories regarding the formation of double salts are criticised, and it is pointed out that Wells' classification of the halogen double salts rests on their comparison under really non-comparable conditions. Z. K.

Application to Thoria of a General Method of Synthesis of Fluorides and Silicates. ANDRÉ G. DUBOIN (*Compt. rend.*, 1908, **146**, 489—491).—The double fluoride, KF,ThF_4, obtained by dissolving thoria in fused potassium hydrogen fluoride, yields thallium fluoride, ThF_4, in the form of brilliant crystals on fusion with excess of potassium chloride or bromide (Abstr., 1895, ii, 351). The crystals belong to the cubic system, elongated in the direction of one of the axes as in certain specimens of cuprite, they melt at a red heat, are not attacked by concentrated sulphuric acid, are slowly decomposed by the dilute acid or by hydrochloric acid, and on fusion with sodium carbonate yield transparent crystals of thoria which closely resemble the crystals of the original fluoride.

Potassium thorium silicate, $K_2O,ThO_2,2SiO_2$, D° 4·44, prepared by the general method already described (Abstr., 1897, ii, 96), forms highly doubly-refracting crystals belonging to the monoclinic or to the orthorhombic system. M. A. W.

Fluorides and Oxides of Quinquevalent Bismuth. OTTO RUFF [with MAX KNOCH and JULIAN ZEDNER] (*Zeitsch. anorg. Chem.*, 1908, **57**, 220—233. Compare Weinland and Lavenstein, Abstr., 1899, ii, 370).—Bismuth trifluoride does not combine directly with fluorine, but traces of a higher fluoride appear to be formed by the action of fluorine on bismuth trichloride at −80°.

When "bismuthic acid" is added to concentrated hydrofluoric acid, a colourless, very unstable solution is obtained, which appears to contain mainly bismuth oxytrifluoride, $BiOF_3$. On evaporating this solution in a vacuum, the oxyfluoride suffered partial decomposition; on addition of potassium fluoride (1 mol.) before evaporation, the *compound* (or mixture), $Bi_3O_4F_7,3KF$, was obtained in small, yellow crystals, and with 3 mols. of potassium fluoride the *compound*, $BiOF_3.3KF$, in well-formed, colourless prismatic crystals, which become yellow and decompose rapidly in moist air.

In order to throw light on the nature of "bismuthic acid" and "alkali bismuthates," on the existence of which doubt has been thrown by Gutbier and Bünz (Abstr., 1906, ii, 174, 234, 551, 678), the solution of the trioxyfluoride was decomposed by water and nitric acid and by alkali respectively, and nearly pure bismuthic acid and sodium bismuthate isolated. In order to obtain the latter, a solution of the pentoxide in 60% hydrochloric acid was cooled to 0°, and added drop by drop to *N*-sodium hydroxide, also at 0°; the yellow precipitate, rapidly washed and partially dried on a porous plate, contained 95—98% of its bismuth in the quinquevalent form, and 1 mol. of sodium hydroxide. On further washing, sodium bismuthate loses alkali and darkens in colour; it does not lose much oxygen, even on heating to boiling, when excess of alkali is present. From this bismuthate, by treating with ice-cold 15% nitric acid to neutral reaction and washing rapidly by decantation, a reddish-brown precipitate containing up to 93% of bismuth pentoxide is obtained. On treating the fresh pentoxide with 15% sodium hydroxide, it slowly changes to yellow bismuthate, so that the statement of Gutbier and Bünz (*loc. cit.*), that the higher oxides of bismuth have no acidic properties, is incorrect. G. S.

Physico-chemical Researches on the "Explosive" Platinum Metals. ERNST COHEN and TH. STRENGERS (*Zeitsch. physikal. Chem.*, 1908, **61**, 698—752).—It has been long known that some at least of the metals of the platinum group are explosive under certain conditions, and the authors have set themselves the task of determining exactly the conditions under which the phenomenon is observed and the cause to which it is due.

To prepare the "explosive" metal, the metal in the ordinary form is alloyed with a large excess of zinc, and the alloy is treated with hydrochloric acid. The residue from this treatment explodes when heated in the case of rhodium, iridium, and ruthenium; from palladium and osmium no explosive residues have been obtained; the platinum residue is sometimes explosive, sometimes not, and the factors which determine this result have not been definitely ascertained.

Explosive rhodium is obtained also when cadmium is used instead of zinc in its preparation. With zinc, the rhodium appears to form a solid solution, and it is not possible to extract all the zinc with hydrochloric acid.

When the rhodium residue is kept at 100° or 200° for a few days, it is no longer explosive. It is shown that explosive rhodium contains hydrogen and oxygen, and that, when the utmost precautions are taken to exclude air during the preparation of the residue, the latter is not explosive. A similar remark applies to iridium. Ruthenium, on the other hand, yields an explosive product even when the greatest care has been taken to exclude air. When rhodium is alloyed with lead, and the alloy is treated with nitric acid, a residue is obtained containing oxides of nitrogen; this residue explodes when heated, even although air is excluded.

The amount of heat developed by the explosion of the "explosive" rhodium is of the same order of magnitude as that calculated on the basis of the view that the explosion is due to the combination of hydrogen and oxygen which have been occluded in the rhodium. This view, in conjunction with the fact, established by the author's experiments, that rhodium becomes passive on contact with nitric acid, gives a satisfactory explanation of all observations made by earlier workers. It is therefore unnecessary to suppose, as Bunsen and Debray did, that the explosion affords evidence of an allotropic change. It is possible, however, that this is the correct explanation in the case of ruthenium.

J. C. P.

The Oxidisability of Platinum. CHARLES MARIE (*Compt. rend.*, 1908, **146**, 475—477).—When plates of platinum or platinum-iridium are placed in an alkaline solution of potassium permanganate at the ordinary temperature for twenty-four hours, the metal becomes superficially oxidised, for on treatment with a dilute solution of potassium iodide and hydrochloric acid they yield red solutions containing platinum (Abstr., 1907, ii, 698), from which the sulphide is precipitated by hydrogen sulphide. Similar results are obtained when the alkaline permanganate solution is replaced by an acid solution of potassium persulphate, dichromate, chlorate, or permanganate, or by an alkaline solution of potassium ferricyanide, or by warm concentrated nitric acid, whilst an acid solution of ferric chloride, or an acid or alkaline solution of hydrogen peroxide, has no oxidising action on platinum. The total loss of weight of a platinum plate 5 cm. × 2·5 cm. after several treatments with an oxidising solution amounts to 0·3 mg., and pure platinum is more readily oxidised than platinum containing 20% of iridium.

It appears therefore that platinum is more readily oxidised at the ordinary temperature than is usually admitted, and the solubility of the oxide thus obtained makes it an easy matter to introduce traces of platinum in chemical or physico-chemical experiments in which platinum is employed. M. A. W.

Freezing-point Diagrams of the Binary Systems Platinum–Arsenic and Bismuth–Arsenic. K. FRIEDRICH and A. LEROUX (*Metallurgie*, 1908, **5**, 148—149).—Platinum and arsenic form a eutectic containing 13% arsenic and solidifying at 597°. By plotting the times of eutectic solidification, the probable existence of a compound Pt_2As_3 is indicated, but it is not possible to study the solidification of mixtures containing more than 28% arsenic.

Bismuth and arsenic are only slightly miscible in the molten state, and separate completely on solidification. C. H. D.

Oxides of Iridium. LOTHAR WÖHLER and W. WITZMANN (*Zeitsch. anorg. Chem.*, 1908, **57**, 323—352).—The methods of preparation and properties of the three oxides of iridium, Ir_2O_3, IrO_2, and IrO_3, have been investigated systematically. The oxide IrO, also mentioned in the literature, does not seem to exist under ordinary conditions.

Iridium dioxide, IrO_2, is best prepared by a modification of Claus's method (1846), by the action of alkali on a hot solution of sodium iridichloride, Na_2IrCl_6, the sesquioxide first formed being oxidised to dioxide by passing a current of oxygen through the solution. The precipitated dioxide can be obtained practically pure by drying at 400° in carbon dioxide, and then boiling with alkali and subsequently with sulphuric acid. The solution obtained by the action of potassium hydroxide on sodium iridichloride in the cold ultimately becomes violet in colour, and contains the dioxide in colloidal solution; after a time, a violet modification of the dioxide separates. On boiling, the violet solution becomes blue, due probably to an aggregation of the colloidal particles; the latter are positively charged. The blue and green solutions obtained by dissolving the dioxide in hydrochloric acid also contain the dioxide in colloidal solution.

The colour of the dioxide depends greatly on the proportion of water present. When dried in a desiccator over sulphuric acid, it contains approximately $2H_2O$, and is black; the water can only be driven off completely by heating at 760°. The anhydrous dioxide is also black. The freshly-precipitated dioxide is much more soluble in acids and alkalis than when dried.

Iridium sesquioxide, Ir_2O_3, is obtained in an impure form by mixing air-free hot solutions of sodium iridium sesquichloride, $Ir_2Cl_6,6NaCl,24H_2O$, and potassium hydroxide in a current of carbon dioxide and evaporating to dryness. The residue is then heated to redness in a current of carbon dioxide, and then further purified by boiling successively with sodium hydroxide and sulphuric acid. In the dry way, as used by Claus (1846), the above method yields only a mixture of iridium and the dioxide.

When heated above 400°, the sesquioxide decomposes into the dioxide and iridium, a little oxygen being liberated simultaneously. As in the case of the dioxide, the properties of the sesquioxide depend on the proportion of water present. With hydrochloric acid, it forms a colloidal solution.

Attempts to obtain the lower oxide, IrO, by decomposition of a corresponding double sulphite, $IrSO_3,M_2SO_3,nH_2O$, with alkali were unsuccessful.

Iridium trioxide, IrO_3, has not been obtained pure. The methods of preparation by fusing finely-divided iridium with potassium nitrate and alkali and with sodium peroxide, as well as by the anodic oxidation of an alkaline solution of the dioxide, yield products containing considerably less than the theoretical proportion of oxygen. Oxygen is also absorbed when the dioxide, mixed with alkali, is heated in oxygen, but not in the amount required to form the trioxide. In the absence of alkali, the dioxide does not absorb oxygen, from which the conclusion is drawn that a trioxide free from alkali is unstable, and that the comparative stability in the presence of alkali depends on the adsorption of the trioxide by the alkali. G. S.

Solid Solutions in the Dissociation of Iridium Oxides. LOTHAR WÖHLER and W. WITZMANN (*Zeitsch. Elektrochem.*, 1908, **14**, 97—107).—The dissociation of iridium dioxide is studied in the same way as that of the oxides of copper and palladium (Abstr., 1907, ii, 33). Undecomposed iridium dioxide gives the highest dissociation pressures. At a constant temperature, the dissociation pressure falls as oxygen is removed from the system, but, after about a quarter of the oxygen has been pumped out, the pressure becomes independent of the composition of the solid phase. There are no discontinuities in the curve connecting pressure and composition at the points corresponding with iridium sesquioxide and monoxide. The sesquioxide, when heated, gives higher pressures than the dioxide, but they are not equilibrium pressures; the oxygen is reabsorbed slowly, and the final pressure is the same as that observed when oxygen is removed from the dioxide. The author considers that the dioxide, when heated, decomposes into oxygen and the metal. The dioxide and the metal are mutually soluble to a limited extent, so that, after a certain amount of decomposition has occurred, the solid consists of two saturated solutions, and therefore gives a constant dissociation pressure. Iridium is most rapidly oxidised to the dioxide by oxygen gas at 1070°. The reaction $IrO_2 = Ir + O_2$ absorbs about 5000 cals. One gram of iridium heated in oxygen at 775° loses 0·33 mg. per hour, and at 1000° about 0·5 mg. per hour. The volatile substance is possibly a tetroxide, which, being endothermic, decomposes on cooling, depositing the oxide. T. E.

Mineralogical Chemistry.

Proximate Constituents of Coal. PETER P. BEDSON (*J. Soc. Chem. Ind.*, 1908, **27**, 147—150. Compare Abstr., 1900, ii, 20; Anderson, *J. Soc. Chem. Ind.*, 1902, **22**, 242).—A résumé of the work of various authors on the action of solvents on different classes of coals and on the proximate analysis of coal, and a preliminary notice of a study of coals from the Busly seam, Boitley, County Durham. Pyridine dissolves 19·38% of the "bright coal" from this seam; a number of products, are obtained by treating the residue from the pyridine extract with various solvents, including a red, crystalline *substance*, m. p. 65°, soluble in light petroleum and volatile with steam, will be described later. The "dant" from the same seam resembles anthracite, containing 9·92% of volatile matter and dissolving in pyridine only to the extent of less than 1%. The proximate analyses quoted for a number of gas coals agree, in general, with the results obtained in the gas works. Proximate analyses of four "cannel" coals and an oil shale are given for comparison. G. Y.

Polymorphous Substances. J. WEBER (*Zeitsch. Kryst. Min.*, 1908, **44**, 212—238).—The literature of the following pairs of dimorphous minerals is recapitulated, and some new observations confirm those of previous authors: blende and wurtzite, metacinnabarite and cinnabar, senarmontite and valentinite. Several analyses of blende and of wurtzite were made to determine the ratio of zinc to sulphur; in blende there is a slight excess of sulphur (0·98—1·97%) over that required by the formula ZnS, whilst in wurtzite there is a deficiency of sulphur (0·21—1·59%). L. J. S.

Change of State in Quartz at 570°. OTTO MÜGGE (*Jahrb. Min.*, 1907, *Festband*, 181—196).—When heated to 570°, quartz suddenly becomes more strongly circularly polarising and birefringent, and on cooling it returns to its original condition. These two modifications of quartz are distinguished as α-quartz (stable below 570°) and β-quartz (stable above 570°); both are tetartohedral-hexagonal, but, as indicated by etching experiments, they probably represent different types of tetartohedrism. L. J. S.

Formation of Dolomite, and the Chemical Precipitation of Calcium Carbonate from Sea-water. E. PHILIPPI (*Jahrb. Min.*, 1907, *Festband*, 397—445).—A general discussion of previous work (compare Abstr., 1899, ii, 306; 1904, ii, 351; 1907, ii, 480). L. J. S.

Chemical Constitution of a North American Monazite Sand. G. P. TSCHERNIK (*Bull. Acad. Sci. St. Petersburg*, 1908, 243—254).—The sample from Carolina contained 78·39% of monazite, the rest being chiefly quartz, garnet, corundum, zircon, titaniferous iron, magnetite, chromite, and columbite, of which the columbite, garnet, titaniferous iron, and magnetite were analysed and described fully.

The monazite consists of more or less perfectly formed crystals with rounded edges of a dark copper-yellow colour, but occasionally light yellow or green. Some of the crystals also show distinct signs of efflorescence and corrosion. The powdered normal dark yellow crystals are decomposed readily by alkalis, alkaline carbonates, acid sulphates, and mineral acids. Analysis gave:

SiO_2.	Cb_2O_5,Ta_2O_5.	ZrO_2.	P_2O_5.	ThO_2.	Ce_2O_3.	$(La,Pr,Nd)_2O_3$.	Y_2O_3.
1·60	4·12	3·25	23·43	1·22	45·40	6·56	2·07

MnO.	Fe_2O_3.	FeO.	Al_2O_3.	Total.
trace	5·58	3·62	2·49	99·34

Z. K.

El Inca Meteoric Iron. FRITZ RINNE and H. E. BOEKE (*Jahrb. Min.*, 1907, *Festband*, 227—255).—This meteoric iron, weighing 320 kilos., was found in 1903 in the nitrate works in the Pampa de Tamarugal, near Iquique in Chile. Analysis by Halbach gave:

Fe.	Ni.	Co.	P.	S.	C.	Cr.	Sp. gr.
90·734	8·200	0·220	0·234	0·001	0·243	0·345	7·64

The structure is octahedral, and large nodules of troilite are present. When the meteoric iron is heated for some hours to 1300°, slight differences in the structure become apparent, indicating that there has been a partial recrystallisation of the material while still in the solid condition.

When iron sulphide and iron are fused together, mixed crystals containing 93% FeS and 7%Fe were obtained; these undergo a change in state at 138°. L. J. S.

Physiological Chemistry.

Gaseous Metabolism in Uræmic Dogs. S. LA FRANCA (*Biochem. Zeitsch.*, 1908, **8**, 180—198).—The gaseous metabolism and respiratory quotient was investigated in dogs before and after removal of the kidneys, or ligature of the ureters. The respiratory quotient rises immediately after the operation, and this is probably due to reabsorption of urinary constituents; it then falls nearly to the normal level, and rises again with the onset of death. The quantities of oxygen absorbed and carbon dioxide given out increase after the operation, and fall considerably when the animal is near death. Complete analytical records of numerous experiments are given.

W. D. H.

Increase in Osmotic Concentration of the Blood during Anæsthesia ANTON J. CARLSON and A. B. LUCKHARDT (*Amer. J. Physiol.*, 1908, **21**, 162—168).—During chloroform and ether anæsthesia, the osmotic concentration of the blood rises. This varies with the depth, but not with the duration, of the anæsthesia. The main factor in this is the ether or chloroform itself dissolved in the blood, but there are other factors, discussed at length, which cannot be altogether excluded. W. D. H.

The Influence of Intestinal Extract on Blood-coagulation. F. CZUBALSKI (*Pflüger's Archiv*, 1908, **121**, 395—403).—Extracts of the intestine intravascularly injected produce the same effect in delaying the coagulation of the blood as is produced by injection of Witte's peptone. It is probable that the active substance is not peculiar to the intestine, but can be also obtained from other tissues, for instance, the brain. W. D. H.

Relative Hæmolytic Power of Serum and Lymph under Various Conditions of Lymph Formation. W. T. HUGHES and ANTON J. CARLSON (*Amer. J. Physiol.*, 1908, **21**, 236—247).—The concentration of hæmolysins for rabbits' corpuscles in the normal body-fluids of dog, cat, and horse exhibits the following descending series: serum, lymph from thoracic duct, neck lymph, lymph from limbs, thyroid, and salivary glands, pericardial fluid, aqueous humor. The cerebro-spinal fluid contains none. The large retro-pharyngeal lymph glands do not influence the hæmolytic power of the lymph which passes through them. Immunisation against typhoid bacilli increases the hæmolytic power of the serum and lymph of the dog. Lymphagogues (peptone, salt, sugar) may increase the hæmolytic properties of lymph from the thoracic duct, but not of that from the neck. This may be accompanied by loss of such power in the serum. The action of peptone on serum is probably due to its action on the liver; this organ probably produces antilysins. W. D. H.

Alkalescence and Acidosis of the Blood. Part II. On the Influence of Alkalis on the Alkalescence of Normal Blood, and of Blood in Cases of Endogenous Acidosis. ANASTAZY LANDAU (*Arch. exp. Path. Pharm.*, 1908, **58**, 207—220).—The analyses were performed by the methods described in the first communication (Abstr., 1905, ii, 330). Experiments were carried out to determine the influence of sodium carbonate (both subcutaneous and *per os*) on the alkalinity of the blood both in normal animals and in animals with experimental acidosis. The latter condition was produced by two methods, starvation and phosphorus poisoning. In the case of normal animals (rabbits), both mineral and organic alkalinity of the blood plasma is increased; this increase is, however, of short duration, and rapidly comes to an end through the excretion of the excess of alkali by the kidneys. The alkalinity of the whole blood is not increased in spite of the increased alkalinity of the plasma; this is due to hydræmia, and, since, normally, the blood corpuscles contain larger quantities of alkali than the plasma, the diminished number in a given volume tends to counteract the increased alkalinity due to the plasma. In the case of starving animals, the effect of alkali is to diminish the acidity due to starvation; on the other hand, in animals poisoned by phosphorus, there is no tendency to increased alkalinity from the injection of sodium carbonate. The difference between the two cases is due to the fundamental difference in the methods of acid production. In starving animals, the acid production is limited, and is due entirely to the breakdown of the fats and proteins to meet the energy needs of the organism; as soon as these needs have been met, the acid production ceases and the acids can be neutralised by the increased alkali in the blood. In the case of phosphorus poisoning, the acid production goes on continually; the alkali is excreted by the kidneys before it is able to reach the cells where the acid is produced; the urine is consequently alkaline, and the acid products subsequently reach the blood. The alkali can, in this case, have only a very temporary effect in diminishing the acidity, and for this reason the injection in cases of diabetic coma is often without result—a toxic acidosis is being dealt with.

S. B. S.

Proteoses in Blood. Emil Abderhalden (*Biochem. Zeitsch.*, 1908, **8**, 360—375).—Polemical against Freund (this vol., ii, 117). His methods and the conclusion that proteoses exist in normal blood-plasma are criticised. W. D. H.

Guaiacum Reaction of Blood. George Senter (*Proc. physiol. Soc.*, 1907, xxxiii—xxxv; *J. Physiol.*, **36**).—The guaiacum reaction is obtained from boiled blood, although it is not so intense as that given by fresh blood. It is probable that there is a substance of non-enzymatic nature in blood responsible for the reaction; it is certainly greater than that which could be produced by the liberation of chlorine from its sodium chloride. W. D. H.

Isotonic and Isosmotic Solutions. Yves Delage (*Compt. rend.*, 1908, **146**, 319—321).—Comparison of the author's results on parthenogenesis in Echinoderms with those of Loeb. The author accepts Loeb's explanation how, if a saline and a sucrose solution are isotonic and the saline solution is isosmotic with an egg, the sucrose solution is not; this is due to sucrose diffusing more slowly through the egg-membrane than the salts which the egg contains.

G. B.

The Work of Digestion. Ernst Heilner (*Zeitsch. Biol.*, 1908, **50**, 488—503).—The author reaffirms his original contention that digestive work in Zuntz's sense does not exist, or rather that the increase of work in the digestive organs during digestion is so small as to be negligible in the study of general metabolism. Rubner's "specific dynamic action" of food-stuffs is, on the other hand, the important factor. W. D. H.

Action of the Amylase of Pancreatic Juice and its Activation by Gastric Juice. H. Bierry (*Compt. rend.*, 1908, **146**, 417—419).—The alkalinity of pancreatic juice, obtained by a temporary fistula and injection of secretin, is equivalent to $N/8$ sodium carbonate (helianthin as indicator). Pancreatic juice hydrolyses starch to maltose, but only very slowly to dextrose, unless the juice is partially neutralised. The best yield of dextrose is obtained by reducing the alkalinity to one-fifth of the original. The action of gastric juice in accelerating the production of dextrose by pancreatic juice is wholly due to the hydrochloric acid, and occurs normally in digestion when the acid contents of the stomach, passing through the pylorus, partially neutralise the pancreatic juice. G. B.

Metabolism of Calcium, Magnesium, and Phosphorus during Inanition. O. WELLMANN (*Pflüger's Archiv*, 1908, **121**, 508—533).—Proofs are adduced that some of the calcium, magnesium, and phosphorus which leave the body during inanition come from the bones. In rabbits, the bones lose about 14% of their weight, and more than half of this falls on the fat. W. D. H.

Parenteral Utilisation of Carbohydrates. LAFAYETTE B. MENDEL (*Proc. Amer. physiol. Soc.*, 1907—8, xii—xiii; *Amer. J. Physiol.*, **21**).—If sucrose is introduced parenterally, over 90% reappears in the urine. Starch similarly administered appears only in part in the urine as dextrin-like substances. The retention is greatest after subcutaneous injection, less after intraperitoneal, and least after intravenous, injection. Tissue amylases are doubtless concerned in the utilisation of the carbohydrate. Moscati claimed to have found complete utilisation, but this was not confirmed.
W. D. H.

Influence of Carbohydrates on Protein Metabolism. JOHN R. MARLIN (*Proc. Amer. physiol. Soc.*, 1907—8, xxi—xxii; *Amer. J. Physiol.*, **21**).—Sucrose added to the diet of a well-nourished dog produced no change in the total urinary nitrogen. In emaciated or pregnant dogs it caused a marked reduction of the nitrogen excreted. In the fat dog, the ammonia eliminated was much increased, and in all cases the creatinine output was raised. In pregnant animals, creatine also passed into the urine on the days on which sugar was given. W. D. H.

Feeding and Other Experiments on Dogs with an Eck Fistula. PHILIP B. HAWK (*Amer. J. Physiol.*, 1908, **21**, 259—281).—After an Eck's fistula has been made, a diet rich in meat may cause toxic symptoms; these, however, are frequently absent, and may then be induced by giving Liebig's extract. The symptoms include anæsthesia, ataxia, catalepsy, tetanus, and loss of sight and hearing; there is usually a fatal termination. If the diet is meat-free, no toxic signs result even if Liebig's extract is given. Sodium carbamate produces no poisonous effects. The animals waste after the operation, but glycosuria and albuminuria are absent. W. D. H.

Composition and Energy-Value of the Food of the Soldier. MARCUS S. PEMBREY and L. E. L. PARKER (*Proc. physiol. Soc.*, 1908, xlix—l; *J. Physiol.*, **36**).—The tables given show that the minimum diet of the British soldier is above 100 grams of protein, 100 grams of fat, and 400 grams of carbohydrate, and possesses an energy value of about 3000 Calories. W. D. H.

Importance of Glutamic and Aspartic Acids as Foodstuffs. KARL ANDRLÍK and K. VELICH (*Zeitsch. Zuckerind. Böhm*, 1908, **32**, 313—342).—The subject is of importance in connexion with the food-value of (beet) molasses, now extensively used as food for cattle. Molasses contain 1·5—2% of nitrogen, which is distributed as follows: proteins and peptones, 10%, betaine, 35—40%, amino-acids, 40%, purine bases, 5—7%. For betaine, it has already been shown (Abstr., 1903, ii, 228; 1905, ii, 266) that it is completely absorbed by herbivora; in carnivora some passes into the urine.

For the present research, a sheep, which was approximately in nitrogenous equilibrium, was given daily 20 grams of glutamic or aspartic acid as the sodium salt; 96% of the former and 98% of the latter acid was absorbed. A portion of the part absorbed (most in the case of the aspartic acid) was used up in protein synthesis; the rest was oxidised to urea, but no acid appeared as such in the urine. The fæces contained protein, 92—94% of which was not digestible by pepsin. G. B.

Composition of Human Brain at Different Ages. WALDEMAR KOCH and SIDNEY A. MANN (*Proc. physiol. Soc.*, 1907, xxxvi—xxxviii; *J. Physiol.*, **36**).—Three brains were examined, one at the age of six weeks, one at two years, and the third at nineteen years. With the growth of the brain a decrease in moisture, proteins, extractives, and ash occurs, whilst there is an increase in cerebrins, lipoid sulphur, and cholesterol, that is, of substances which predominate in the white matter. W. D. H.

The Smallest Molecule from which the Liver can make Glycogen. KARL GRUBE (*Pflüger's Archiv*, 1908, **121**, 636—640).—By perfusion of the tortoise's liver with a weak (0·01—0·02%) solution of formaldehyde, it was found that the liver was able to form glycogen from it. W. D. H.

The Capacity of the Liver to Reverse the Optical Action of Sugars. EDUARD PFLÜGER (*Pflüger's Archiv*, 1908, **121**, 559—571).—The administration of lævulose leads to the formation of glycogen in the liver, but the glycogen formed is not lævorotatory; the liver cells have therefore the power to transform the sugar given into dextrose, and it is this from which the glycogen is formed. W. D. H.

Changes in Uric Acid in Animals and Men. ALFRED C. CROFTAN (*Pflüger's Archiv*, 1908, **121**, 377—394).—Uric acid was mixed with minced organs and tissues, or their extracts, and the loss in the amount of uric acid estimated; the human liver has greater power in this direction than the livers of other animals; the same is true for the kidneys; the muscles, however, surpass all other tissues in this power. The power of the human spleen, on the other hand, is relatively small, and that of the blood almost negligible. Neither nucleo-protein nor a proteose separated from the extracts destroys uric acid, but a mixture of the two does so. The proteose does not decompose hydrogen peroxide. As to what happens to the uric acid, nothing very definite was discovered; a small increase in urea and oxalic acid was noticed, but little or no formation of allantoin.

W. D. H.

The Influence of Colloids on Ferments. LUDWIG PINCUSSOHN (*Biochem. Zeitsch.*, 1908, **8**, 387—398).—Ascoli and Izar (this vol., ii, 121) have shown that small quantities of colloidal silver, gold, and platinum have a distinct action in increasing the rate of action of the autolytic enzyme of the liver. Experiments were made to determine the influence of colloids on pepsin digestion. In no case was the rate of action increased. S. B. S.

Leucomaines of Cod-liver Oil. PHILIP B. HAWK (*Proc. Amer. physiol. Soc.*, 1907—8, xxii—xxiii; *Amer. J. Physiol.*, **21**).—The total amount of leucomaines isolated by the method of Gautier and Mourgues from oils of different tint varied from 1·06 to 1·17 grams per kilogram of cod-liver oil. By fractional distillation, butylamine, amylamine, hexylamine, and dihydrolutidine were separated. From the non-volatile portion, morrhuine was identified, but not the aselline of Gautier and Mourgues. W. D. H.

Refractory Period of the Frog's Sartorius. H. C. BAZETT (*J. Physiol.*, 1908, **36**, 414—430).—The refractory period is lengthened by fatigue, injury, or normal saline solution. A lowering of temperature acts in the same way, and the lengthening obeys Arrhenius' law of the velocity of chemical reactions. Potassium salts lengthen, and calcium salts shorten, the refractory period. Chloral hydrate, after a short initial effect in lessening it, increases the length of the period. W. D. H.

Relative Resistance of Cardiac Muscle and Nerve to Drugs. WALTER J. MEEK (*Amer. J. Physiol.*, 1908, **21**, 230—235).—Alkaloids, anæsthetics, and other chemical substances produce paralysis of the *Limulus* heart tissues in the following order: (1) ganglion, (2) motor nerve plexus, and (3) muscle. W. D. H.

Creatine and Creatinine. EDWARD MELLANBY (*J. Physiol.*, 1908, **36**, 447—487).—Among the many contradictory statements relating to the proportion of creatine to creatinine in muscle, that of Monari, who says that the latter increases at the expense of the former when muscle becomes active, has usually been regarded as most trustworthy. It is now shown that Monari's technique afforded an opportunity for the change to occur, and, moreover, his precipitates were impure; and it is shown that creatinine is never present in muscle at all even after prolonged muscular work; the original amount of creatine remains unaltered after work, and also, in frog's muscle, after survival for three days. When the muscle becomes septic, all the creatine disappears. Aseptic or antiseptic autolysis causes no change in creatine or creatinine. Gottlieb and Stangassinger's statements (Abstr., 1907, ii, 637) regarding numerous tissue enzymes which affect these substances were in no single respect confirmed.

Creatine and creatinine feeding has no effect on the creatine of muscle after the muscle has reached a certain saturation point. In one set of chickens only, the muscular creatine was slightly increased by glycocyamine feeding, but this is not universal. In early life, also, creatine feeding and possibly creatinine feeding increase the muscular creatine, but the normal differences in chickens are unknown, and this factor has to be eliminated before the fact can be established. Creatinine feeding leaves the muscles still free from that substance.

Before the twelfth day of incubation in the chick, creatine is absent from the muscles; after this date the liver and the muscular creatine develop *pari passu*. After hatching, the liver still continues to grow rapidly, creatine formation increases also, but muscular growth is slow.

Invertebrate muscle even when striated does not contain creatine. The invertebrate "gland of the mid-gut" has no morphological or physiological connexion with the vertebrate liver.

The small amount of creatinine excreted in hepatic disease gives support to the view that the liver is responsible for the formation of creatinine. The excretion of creatine in cancer of the liver makes it probable that, where muscle cells break down, creatine is liberated without conversion into creatinine before excretion. Creatinine, after the earlier period of life, is an excretion product of metabolism; creatine has no influence on muscular contraction or on the passage of nervous impulses into muscle.

The general conclusion reached is that the liver is continuously forming creatinine from substances carried to it by the blood from other organs, and that in the developing muscle this is changed to creatine and then, when the muscle is saturated with creatine, creatinine is continuously excreted. If creatine (an innocuous neutral substance) was converted by the muscles into creatinine (a strongly basic substance) it would be contrary to all that is known of the chemical changes which occur in the body. W. D. H.

Chemical Processes in the Earth-Worm. Ernst J. Lesser. **The Ferments of the Earth-Worm.** Ernst J. Lesser and Ernst W. Taschenberg (*Zeitsch. Biol.*, 1908, **50**, 421—445, 446—455).—During inanition, the respiratory quotient of the earthworm sinks. In the early stages, fat and glycogen are used up, but later, as glycogen disappears, its decomposition is relatively small. The output of nitrogen remains constant, between 2 and 4 mg. per fifteen animals per day. Products of incomplete carbohydrate breakdown are not contained in the excretions. Ammonia is present, which is not the case in *Ascaris* and the leech.

The hydrolysing ferments present are those which act on protein, starch, and glycogen, also invertase and lipase. Catalase and aldehydase (?) are present. Lactase, inulinase, cytase, tyrosinase, and a ferment which renders guaiacum blue are absent. W. D. H.

The Organic Substance of the Skeletal Tissues of Anthozoa. II. Carl Th. Mörner (*Zeitsch. physiol. Chem.*, 1908, **55**, 77—83).—The previous work (Abstr., 1907, ii, 283) was undertaken with the skeletal tissue of the *Gorgonacea.* The investigations have now been extended to the *Pennatulacea*, the *Alcyonacea*, and the *Antipathidea.* The following general results have been arrived at. In all cases the halogens are in organic combination; iodine is present in all cases (from traces up to 7%), also bromine (in quantities of 0·25 to 4%) with the exception of two *Antipathidea*, and chlorine (generally only about 0·2%). The variations are independent of climate, composition of sea-water, age, &c., and also of the physical properties of the skeletal substance. The organic substance of the *Pennatulacean* skeleton, provisionally called *Pennatulin*, differs from that of the other Anthozoa by its solubility in pepsin-hydrochloric acid. The amount of sulphur in the skeletons of all members of the group is so low that the organic substance cannot be regarded as a keratin. It is probable that halogens are far more widely distributed in the tissues of marine organisms than has hitherto been considered probable. S. B. S.

The Rôle of Calcium Salts in the Mechanical Inhibition of the Ctenophore Swimming-plate. Ralph S. Lillie (*Amer. J. Physiol.*, 1908, **21**, 200—220).—Mechanical stimulation arrests the activity of the swimming-plate; this susceptibility is dependent on the presence of calcium salts. Strontium and barium cannot take the place of calcium. The essential action of the calcium consists in decreasing the permeability of the contractile tissue to ions. Mechanical stimulation favours the entrance of calcium ions into the fibrils. W. D. H.

The Nitrites of the Saliva, and their Origin. Jules Ville and W. Mestrezat (*Bull. Soc. chim.*, 1908, [iv], **3**, 212—217).—Schönbein observed, in 1862, that saliva contains nitrites, as shown by its action, when acidified, on potassium iodide and starch. The authors show that saliva, when obtained pure by the catheterisation of the ducts of the parotid and sub-maxillary glands, does not contain nitrites; it does, however, contain nitrates in quantities varying from 10—300 mg. per litre in different individuals. The quantities increase considerably after ingestion of nitrates in the food. The nitrites in the saliva are stated to be due to the reducing action of a certain species of bacteria on the nitrates in the buccal cavity. These bacteria, when inoculated in Winogradski's medium containing nitrates (0·1 gram per litre), can reduce as much as 50% in twenty-four hours. S. B. S.

Action of Lymphagogues on the Concentration of Agglutinins in Serum and Lymph. B. Braude and Anton J. Carlson (*Amer. J. Physiol.*, 1908, **21**, 221—229).—Serum, thoracic lymph, neck lymph, and pericardial fluid of dogs contain agglutinins for typhoid bacilli. The order named is the order of activity. Aqueous humor and cerebro-spinal fluid contain no agglutinin. The agglutinating action runs parallel to the hæmolytic power of the fluids. In cats, on the other hand, agglutinins are usually absent from all the fluids, but, after immunisation against the typhoid bacillus, the fluids have an agglutinating action, and the relative concentration in the different fluids is the same as in dogs. Lymphagogues (strawberry-extract, 10% peptone, 10% sucrose, 5% sodium chloride) have no effect on the concentration of agglutinins. W. D. H.

Behaviour of Rennet and Acid to Human Milk. Ernst Fuld and Julius Wohlgemuth (*Biochem. Zeitsch.*, 1908, **8**, 376—377. Compare Abstr., 1907, ii, 797).—The authors disagree with Bienenfeld's conclusion (this vol., ii, 121), that human milk cannot be curdled by rennet, on several grounds, one of which is that, if the amount of calcium chloride in the milk is increased, curdling occurs in the usual way. W. D. H.

Excretion of Sugar in Healthy Men, and the Estimation of Small Quantities of Sugar in Urine. Bernhard Schöndorff (*Pflüger's Archiv*, 1908, **121**, 572—603).—Using large quantities of urine, it is possible to detect sugar in many healthy people by the Worm-Müller reaction, and even if this test is negative, it is still possible in many cases by concentrating the acidified filtrate after precipitation by mercuric nitrate; the sugar can then be estimated by the Fehling-Soxhlet method. Quantities varying from 0·005% upwards can be detected. In the urines of over three hundred soldiers, 95% contained sugar, and in few cases as much was found as in diabetes. This is attributed to diet; in civilians, who did not take so much carbohydrate, 85% secreted a sugar-free urine. The sugar was identified as dextrose by means of its osazone. W. D. H.

Metabolism in a Case of Coma under Rectal Feeding. P. P. Laidlaw and John H. Ryffel (*Proc. physiol. Soc.*, 1908, xlvii—xlix; *J. Physiol.*, **36**).—Details are given of the composition of urine and fæces of a man in a state of coma, who was fed *per rectum*. The nitrogen excretion is low, and roughly equal to that obtained in the later stages of fasting. Creatine was absent from the urine. Urorosein was present; this disappeared on the resumption of mouth feeding. The absence of stercobilin in the fæces suggests that a prolonged stay of bile pigments in the intestine is favourable to the production of urorosein. Zawidzky obtained a substance apparently identical with urorosein by oxidising pure urobilin. W. D. H.

Action of Therapeutic Agents on the Gastric Secretion. III. Action of Iodine in the Promotion of Secretory Activity. Johann Feigl (*Biochem. Zeitsch.*, 1908, **8**, 467—519).—Experiments were made to determine the rate of secretion of gastric juice in dogs with a Pawloff fistula after the ingestion of iodine and various iodine compounds. Water was first administered, and the gastric juice collected and measured, the quantity excreted in each half-hour being noted. As soon as the excretion had stopped, the same quantity of water containing iodine or the iodine compound was administered, and the amounts of secretion measured at half-hourly intervals. The administration of iodine and iodides caused considerable increase in the amount of secretion; iodine itself was particularly powerful; 200 c.c. of water caused a secretion of 4·8 c.c. of gastric juice, the secretion of which ceased after two hours; the same quantity of water, containing 0·05 gram of iodine, caused a secretion of 22·5 c.c. of juice, which ceased to be secreted only after four hours. Potassium iodate had also a powerful action. Experiments were also made with iodised fats and proteins. The fat derivatives acted in varying ways, some acting like the iodides, others having but little action. As a general result, it was found that the iodine compound in all cases when ions could be formed, caused considerable secretory activity. S. B. S.

Biochemistry of Colloids. Johann Feigl and Adolf Rollet (*Biochem. Zeitsch.*, 1908, **8**, 145—179).—Various colloid preparations of metals and metallic compounds prepared chiefly by Paal's method, such as the commercial preparations collargol, lysargin (silver colloid), hygrol (mercury colloid), &c., were administered to a dog with a Pawloff gastric fistula. In all cases there was a considerably increased secretion of gastric juice as compared with that obtained by the administration of the same quantity of water without the colloid. The colloidal condition has some specific action therefore of promoting gastric secretion which is not possessed by the metals when administered in the form of ordinary ionisable salts. S. B. S.

Antagonistic Action of Calcium and Magnesium Samuel J. Meltzer and John Auer (*Proc. Amer. physiol. Soc.*, 1907—8, xi; *Amer. J. Physiol*, **21**).—The paralysis and anæsthesia produced in an animal by the injection of a magnesium salt disappear about one minute after the injection of a calcium salt. In plant life, also, the cure for too much magnesium in the soil is "liming." W. D. H.

Action of Hydrocyanic Acid on Protein Katabolism. Adolf Loewy, Charles G. L. Wolf, and Emil Österberg (*Biochem. Zeitsch.*, 1908, **8**, 132—144).—Three experiments on dogs, which were given respectively small, medium, and large doses of hydrocyanic acid, are described. In all there was a rise of nitrogenous katabolism; the amount of urea is also increased, so that the proportion of urea to total nitrogen does not sink. The ammonia excretion is very slightly lessened; the amount of urinary creatinine sinks markedly, but creatine appears also in the urine; the residual nitrogen is increased. The relation of sulphates to total sulphur is lessened, and the total phosphorus rises. W. D. H.

Action of Benzidine on the Animal Body. Oscar Adler (*Arch. exp. Path. Pharm.*, 1908, **58**, 167—197).—Symptoms of intoxication are produced in a dog by doses of 1 to 3 grams of benzidine, as such or as a salt, suspended, or dissolved, in water or alcohol; they are the same whether the drug is given by stomach-tube or by subcutaneous injection. Vomiting first sets in, followed by symptoms indicating excessive excitement of the motor centres, and analogous to those produced by cocaine poisoning. A condition of fatigue and somnolency follows, and the animal dies generally after a period of several days; recovery is, however, possible. These symptoms were accompanied by glycosuria and, in the case of rabbits, blood-corpuscles appeared in the urine containing a changed blood-pigment, which is insoluble in water, and in the case both of rabbits and dogs an abnormal urinary pigment was formed. Very little, if any, unchanged benzidine is recovered in the urine, but a substance has been isolated melting between 130° and 138° of the formula $C_{12}H_6(OH)_2(NH_2)_2$, which is presumably 4 : 4′-diaminodihydroxydiphenyl. S. B. S.

Purgative Action of Phenolphthalein and of its Disodium Derivative. C. Fleig (*Compt. rend.*, 1908, **146**, 367—370).—The action, which is much more marked on man than on animals, is due to increased secretion and not to increased peristalsis. The disodium derivative is soluble in water, and is more active than the parent substance; it can be given hypodermically. G. B.

Effect of Strychnine on Muscular Work. P. C. Varrier-Jones (*J. Physiol.*, 1908, **36**, 435—446).—Ergographic experiments on man show that small doses of strychnine produce an immediate increase in the power to do work, especially if the drug is taken early in the day. A fall then follows, and the capacity remains subnormal for hours. The effect of successive doses is cumulative. It is suggested that the effects are produced by a diminution of the resistance of the spinal cord to the entry of sensory impulses, and the after effect may be due either to the poisonous action of the drug or to pure fatigue.

W. D. H.

Chemistry of the Infundibular Portion of the Pituitary Body. Thomas B. Aldrich (*Proc. Amer. physiol. Soc.*, 1907—8, xxiii—xxiv; *Amer. J. Physiol.*, **21**).—A crystalline picrate of the substance which raises blood-pressure was prepared from the extract of the infundibulum, which had previously been freed from protein. The sulphate was prepared from the picrate. Both these salts raise blood-pressure. Platinum chloride also gives a double salt.

W. D. H.

The Sensory Nerves of the Heart and Vessels as a Factor in Determining the Action of Drugs. D. E. Jackson and Samuel A. Matthews (*Amer. J. Physiol.*, 1908, **21**, 255—258).—The fall of blood-pressure in early stages of aconitine poisoning is too great to be accounted for by the cardiac weakness, and the vasomotor nerves respond well on stimulation. Some experiments recorded seem to confirm the suggestion that the alkaloid acts on the terminations of the depressor nerve, and there are indications that other sensory nerve-endings may be affected. W. D. H.

The Action of Cobra Venom in Destroying Complement. Julius Morgenroth and R. Kaya (*Biochem. Zeitsch.*, 1908, **8**, 378—382).—The disappearance of complement from serum under the influence of snake poison is due either to the action of a ferment in the latter which destroys the former, or to a combination between the amboceptor of the venom and the complement of the serum to form an inactive compound. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Laws of Disinfection. HARRIETTE CHICK (*J. Hygiene*, 1908, **8**, 92—158).—In anthrax spores, the disinfection process obeys the equation for a unimolecular reaction if "concentration of reacting substance" is replaced by "numbers of surviving bacteria." In *B. paratyphosus* this law does not hold, for the younger bacteria are more resistant than the others. The process is influenced by temperature, and the equation of Arrhenius can be applied ; from this follows the advantage of using warm solutions in practical disinfection. In the case of some metallic disinfectants, the metallic ion appears to be the active agent. In disinfection with mercuric chloride, a toxic compound is formed between the metal and the substance of the bacterial cell. This compound prevents further growth, but vitality can be restored by a large excess of soluble sulphide. W. D. H.

Relative Efficiency of Filters. WILLIAM BULLOCH, J. A. CRAW, and E. E. ATKIN. **Grain of Filters and Growth of Bacteria through Them.** J. A. CRAW (*J. Hygiene*, 1908, **8**, 63—69, 70—74).—Of the filters tested, the Doulton filters alone prevented the direct transmission of micro-organisms. Berkefeld filters and Slade and Brownlow filters gave contaminated filtrates within fifteen minutes of the commencement of filtration. Striking photomicrographs of the size of the pores in the filters show that this is inversely proportional to the efficiency of the filters. W. D. H.

Micro-organisms Oxidising Hydrogen. II. BRONISLAW NIKLEWSKI (*Centr. Bakt. Par.*, 1908, **20**, ii, 469—473. Compare Abstr., 1907, ii, 380).—The condensation of hydrogen and oxygen by the soil is due to two organisms, living symbiotically and together constituting the membrane formed on mineral solutions in an oxygen-hydrogen atmosphere. The fact that neither organism when grown by itself can oxidise hydrogen, and that morphologically they greatly resemble each other, accounts for the difficulties of obtaining a pure culture. The author doubts the identification of Kaserer's organism (Abstr., 1906, ii, 113, 697) with *Bacillus oligocarbophilus* ; in his own cultures, he never observed nitrification, nor did growth take place in a carbon monoxide atmosphere, as described by Kaserer. In spite of these differences, the author regards his organism as probably identical with that of Kaserer, and probably also with that of Nabokich and Lebedeff (Abstr., 1907, ii, 43). G. B.

Survival of Bacillus Typhosus in Soil. W. MAIR (*J. Hygiene*, 1908, **8**, 37—47).—The typhoid bacillus survives in soil for seventy to eighty days, but there is no evidence that it multiplies and leads a saprophytic existence there. If the soil has been sterilised previously by steam under pressure, the bacillus dies out more rapidly (eleven days), but this does not obtain in all cases. Sterilisation apparently produces bactericidal substances. W. D. H.

Chemical Constitution and Biological Properties of the Protoplasm of Koch's Bacillus. JULES AUCLAIR and LOUIS PARIS (*Compt. rend.*, 1908, **146**, 301—303).—Tubercle bacilli were freed from soluble proteins and from the fatty wax, and then extracted at 80° with concentrated acetic acid; on almost completely neutralising the extract with sodium hydroxide, flakes are precipitated which resemble a nucleo-casein. When injected in doses of 1 mg., this *bacillo-casein* produces small tumours in the rabbit and the guinea-pig. It and the fatty wax are the essential poisons of tubercle bacilli. G. B.

Nitrification. LESLIE C. COLEMAN (*Centr. Bakt. Par.*, 1908, ii, **20**, 401—420, 484—513).—In accordance with Bazarewski's results, it was found that nitrification in non-sterilised soil may be considerably increased by small amounts of dextrose (to 0·5%). The greatest effect is produced in the second and third weeks; subsequently the effect diminishes, whilst denitrification, due to organic matter, increases.

Sucrose, glycerol, and lactose in small amounts seem to have a favourable effect; no effect was detected in the case of calcium butyrate whilst calcium acetate seems to retard nitrification. Peptone and urea (0·5% and 0·75% respectively) greatly retard nitrification.

Nitrification in a loam was most active in presence of 16% of water, and was much retarded when the amount of water was reduced to 10% or increased to 26%; in presence of an excess of water, dextrose is injurious instead of beneficial.

Approximately pure cultures of nitrate and nitrite organisms in sterilised sand or soil are rendered more active by 0·02—0·05% of dextrose; under similar conditions, pure cultures of the nitrate organism seem to acquire increased activity in presence of 0·05% of dextrose. A supply of carbon dioxide is necessary in presence, as in the absence, of dextrose.

Carbon disulphide has at first a very decided retarding action on nitrification; subsequently, nitrification is increased, owing no doubt to a stimulating action. N. H. J. M.

Carbohydrates of Yeast. WILHELM MEIGEN and A. SPRENG (*Zeitsch. physiol. Chem.*, 1908, **55**, 48—73).—Two carbohydrates can be obtained from the cell membrane of yeast, "*yeast gum*" and "*yeast cellulose.*" The yeast gum has been prepared in different ways, such as by boiling the yeast with water (Nägeli and Low, Béchamp, and Schützenberger), by boiling with chalk (Hessenland), and by boiling with dilute potassium hydroxide and precipitation of the polysaccharide with Fehling's solution (Salkowski). The preparations so obtained show different specific rotations varying from 47·6° to 98·2°. This is due to the fact that the "yeast gum" obtained by different processes contains admixtures of other substances, such as proteins, glycogen, and hemicellulose. Salkowski's method gives the purest preparation (with a_D 91·1°). Hydrolysis with 3% sulphuric acid gives a mixture of mannose and dextrose in the molecular proportions of 2 : 1. Pentoses seem to be absent.

Two other carbohydrates were prepared from the yeast in the following way.

The yeast was treated for six months with 0·25% potassium hydroxide, which was changed at intervals. The residue was repeatedly treated with alcohol, until the water was removed, and then dried. This preparation gave a brown colour with iodine and sulphuric acid, and also with iodine dissolved in potassium iodide; it was insoluble in ammoniacal copper hydroxide solution. On treatment with 3% sulphuric acid (20 times the quantity for ten hours), or with 15% sodium hydroxide (for four hours), two-thirds of the quantity went into solution; on evaporation of the solution and addition of alcohol, a carbohydrate was precipitated which, after purification, had a rotatory power of +113°; it gave no precipitate with Fehling's solution, but a precipitate with lead acetate and baryta water. It differs therefore from the yeast gum. On hydrolysis, it yields only dextrose. This substance is, then, *yeast dextrose*, and seems to be identical with Salkowski's erythro-cellulose.

The insoluble residue from the hydrolysis with 3% sulphuric acid, or 15% sodium hydroxide, is another hydrocarbon, *yeast cellulose*; on hydrolysis in the cold with 80% sulphuric acid, it yields mannose and dextrose in approximately equal molecular proportions; it seems to be identical with Salkowski's achroo-cellulose. It does not give, however, the typical cellulose reactions, and is not present in the yeast cell in this form, but is produced from the original hydrocarbons by hydrolysis.

S. B. S.

The Influence of the Chemical Constitution of the Nitrogenous Nutriment on the Fermentative Action and Growth of Certain Fungi. II. HANS PRINGSHEIM (*Biochem. Zeitsch.*, 1908, **8**, 119—127. Compare Abstr., 1907, ii, 44).—As in the case of yeast, the capability of producing the alcoholic fermentation, being due to the presence of amino-acid groups, is true also for the fungi *Rhizopus tonkinensis*, *Mucor racemosus*, and *Torula I*, but is not the case for *Allescheria Gayonii* or *Torula V*. As was found also by Czapek for *Aspergillus niger*, this source of nitrogen favours the growth of *R. tonkinensis*, *M. racemosus* and *Torula V*, but not of *A. Gayonii*.

W. D. H.

Formation of Fusel Oil by Certain Fungi. HANS PRINGSHEIM (*Biochem. Zeitsch.*, 1908, **8**, 128—131).—Various fungi which produce the alcoholic fermentation were investigated. All of these possess the power of converting leucine into amyl alcohol, and the smaller the amount of ethyl alcohol formed the richer it is in fusel oil.

W. D. H.

Fixation of Zinc by Sterigmatocystis nigra. Maurice Javillier (*Compt. rend.*, 1908, **146**, 365—367).—The growth of this mould (= *Aspergillus*) is stimulated by minute traces of zinc, up to 1 part in 10,000,000 parts of the culture fluid. At higher concentrations up to 1 in 250,000, growth is not accelerated any further, but the fungus assimilates, nevertheless, the whole of the zinc, which no doubt is useful. From concentrations of 1/250,000 to 1/25,000, a portion of the zinc is absorbed, the excess being harmless. In solutions containing more than 1 part in 25,000, the *Aspergillus* no longer attains its normal weight. Although the beneficial effect of traces of zinc (and of other poisonous metals) is well known, the direct proof of the fixation of the zinc is now given for the first time. G. B.

Active Principles of the Fruit of an African Strychnos. Alexandre Hébert (*J. Pharm. Chim.*, 1908, [vi], **27**, 151—155).—The fruit of *Strychnos aculeata*, from the Ivory coast of Africa, contains neither strychnine nor curarine, but traces of brucine. It contains in addition an active principle, which is non-volatile with steam and is toxic to fish, but not to mammals. It exerts this toxic action in doses corresponding with 1 part of the fruit in 10,000 parts of water. S. B. S.

Chemical and Bacteriological Effects of Liming. Edward B. Voorhees, Jacob G. Lipman, and Percy E. Brown (*New Jersey Agric. Exper. Stat. Bul.*, 1907, **210**).—Experiments on the effect of burnt lime and calcium carbonate on oats and crimson clover grown in boxes containing 50 lb. of a market garden soil somewhat sandy and of a red shale arable soil respectively.

In many cases, the application of lime reduced the yield of dry matter and increased the yield of nitrogen; magnesian lime caused a greater depression in the yield of dry matter than non-magnesian lime. On the other hand, ammonification and nitrification were promoted by liming, and more by magnesian than by non-magnesian lime.

The amounts of lime applied were not sufficient seriously to affect the CaO/MgO ratio. The diminished yield of dry matter under the influence of lime is attributed to a decreased supply of available phosphoric acid, accumulation of injurious substances due to bacterial activity being increased by the lime, or to the utilisation of plant-food by the increased numbers of soil organisms. Actual countings by the plate method and by Hiltner and Stormer's dilution method showed an enormous increase of soil organisms under the influence of soil treatment. N. H. J. M.

Proteins of Rice. Otto Rosenheim and S. Kajiura (*Proc. physiol. Soc.*, 1908, liv—lv; *J. Physiol.*, **36**).—Rice yields 7% of total protein, of which 0·14% is a globulin, 0·04% an albumin, and the remainder a protein, which like the glutenin of wheat is soluble only in dilute alkali; the name oryzenin is suggested for it. It gives all the usual protein colour reactions. The almost complete absence of a gliadin (or alcohol-soluble protein) explains why rice is unsuitable for making dough and bread. The addition of barley to rice diet prevents outbreaks of Beri-beri. It is suggested that the increased supply of glutamic acid in hordein (the alcohol-soluble protein of barley) may partly explain this. W. D. H.

Analytical Chemistry.

Detection of Free Hydrochloric Acid in the Stomach Contents. F. A. STEENSMA (*Biochem. Zeitsch.*, 1908, **8**, 210—211).—The following modification of the Günzberg solution is recommended: phloridzin, 2 grams, vanillin, 1 gram, absolute alcohol, 30 c.c. To carry out the test, the inverted cover of a crucible is placed on a water-bath and warmed. When hot, a drop of the reagent is added; the alcohol evaporates, and leaves a faint yellow ring. In the middle of this ring, where there is no reagent, one or two drops of the liquid under investigation are placed. If hydrochloric acid is present, a bright red edge will form on the inside of the yellow ring on evaporation; if only small quantities of hydrochloric acid are present, only a thin red line will be formed. The reagent will not keep long, and should be freshly made for the test, especially if methyl alcohol is employed instead of ethyl alcohol. S. B. S.

Fluorine in Œnological Products. P. CARLES (*Ann. Chim. anal.*, 1908, **13**, 102—104).—The author calls attention to the fact that traces of fluorine compounds may be introduced into wines by the use of animal charcoal, some kinds of tannins (China galls), clarifying agents (gelatins) to which hydrofluosilicic acid has been added as a preservative, &c. L. DE K.

Detection of Hydrogen Peroxide in Milk. E. FEDER (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 234—236).—The presence of 0·01% of hydrogen peroxide in milk may be detected by heating 5 c.c. of the milk, 5 c.c. of hydrochloric acid, D 1·19, and 1 drop of dilute formaldehyde solution to a temperature of about 60° for three or four minutes. If hydrogen peroxide is present, a violet coloration is obtained. Fresh milk treated in the same way gives a yellow coloration. Other substances, however, besides hydrogen peroxide give a violet coloration when heated with milk and hydrochloric acid in the presence of formaldehyde. Of these, nitric and nitrous acids may be mentioned. Milk containing added water may give a coloration, indicating the presence of hydrogen peroxide, but in reality due to the nitrous acid (nitrite) introduced along with the water. In testing watered milk, the presence or absence of nitrous acid should therefore be established by means of other tests. W. P. S.

Estimation of Small Quantities of Oxygen and Carbon Dioxide in Small Volumes of Saline Solutions. THOMAS G. BRODIE and WINIFRED C. CULLIS (*J. Physiol.*, 1908, **36**, 405—413).—A simple method is described of boiling off and collecting the gases from small amounts of oxygenated Ringer's solution used to perfuse surviving organs. The gas bubble is then introduced into a carefully-calibrated capillary tube, and its length measured; potassium hydroxide is then introduced to absorb the carbon dioxide, and an alkaline solution of pyrogallol acid to absorb the oxygen; the diminution of the length of the bubble is a measure in each case of the amount of gas absorbed; the final residue is nitrogen. W. D. H.

Differential Method of Blood-Gas Analysis. JOSEPH BARCROFT (*Proc. physiol. Soc.*, 1908, lii; *J. Physiol.*, **36**).—Equal quantities of venous and arterial blood in separate bottles are connected to the manometer of the Barcroft-Haldane apparatus. The blood is then laked as usual, potassium ferricyanide added, and the oxygen liberated. The difference of the levels in the fluid in the manometer is a measure of the amounts of oxygen in the two fluids. The carbon dioxide can then be liberated by tartaric acid, and another reading taken. For oxygen estimation, the ferricyanide may be omitted, and the two samples of laked blood simply shaken with the air; both samples will then saturate themselves with oxygen, and the same difference of level will be produced. W. D. H.

Estimation of Gases in Human Blood by the Chemical Method. JOSEPH BARCROFT and P. MORAWITZ (*Proc. physiol. Soc.*, 1908, lvi; *J. Physiol.*, **36**).—Doubt has been expressed as to whether the ferricyanide method is efficient for human blood. The present series of experiments on five persons shows that it is. W. D. H.

New Process for the Estimation of Sulphur in Organic Substances. ISIDORE BAY (*Comp. rend.*, 1908, **146**, 333—334).—The substance is heated in a tube with sodium carbonate and magnesia; a current of oxygen is passed through the tube during the combustion, and the sulphuric acid formed is estimated subsequently by dissolving the contents of the tube in dilute hydrochloric acid and precipitating with barium chloride. The combustion tube may be filled as follows: firstly, a plug of asbestos 3 cm. in length; then 10 cm. of a mixture consisting of equal weights of sodium carbonate and magnesia; next, the substance to be analysed mixed with sodium carbonate and magnesia, and, finally, another layer of the mixture of sodium carbonate and magnesia about 20 cm. in length, a second plug of asbestos being employed to close this end of the tube. The exit end of the tube may be connected with a Liebig bulb containing sodium hydroxide and bromine to prevent any loss of volatile sulphur compounds. The quantity, if any, of sulphuric acid yielded by the sodium carbonate and magnesia must be estimated separately and deducted from the result obtained. The process is suitable for the estimation of sulphur in mercaptans, ethyl sulphide, allylthiocarbimide, thiophen, &c. In the case of liquids, the substance is introduced into the combustion tube in a small glass tube. W. P. S.

Detection of Sodium Sulphite in the Presence of Sulphate and Thiosulphate. FRANK E. WESTON and C. W. JEFFREYS (*Chem. News*, 1908, **97**, 85).—The solution is precipitated by means of lead nitrate or acetate, the precipitate is washed by decantation, and treated with *N*-thiosulphate. The lead sulphate and thiosulphate dissolve, whilst lead sulphite is insoluble.

The precipitate is washed and then treated with a little dilute sulphuric acid. The solution now contains sulphur dioxide, which is tested for in the usual way by the odour, or by means of permanganate, &c. L. DE K.

Estimation of Ammonia in Water. A. RONCHÈSE (*J. Pharm. Chim.*, 1908, **27**, [vi], 231—235; *Bull. Soc. chim.*, 1908, [iv], **3**, 362—366).—The method described previously (Abstr., 1907, ii, 651) may be applied to the estimation of ammonia in water. From 250 c.c. to 1 litre of the water are acidified with sulphuric acid and evaporated to a volume of about 40 c.c.; the solution is then neutralised, using phenolphthalein as indicator, and 4 c.c. of a neutral 20% formaldehyde solution are added. The solution is next titrated with *N*/100 sodium hydroxide solution until the pink coloration reappears. Owing to the influence of the ammonium salts on the indicator, a correction is applied to the number of c.c. of alkali required for the titration, 0·1 c.c. being added for every 3 c.c. of *N*/100 sodium hydroxide used. W. P. S.

Nitrates, Nitrites, and Ammonia in Sea-water. WILHELM E. RINGER and MEJ. I. M. P. KLINGEN (*Chem. Weekblad*, 1908, **5**, 147—168).—The authors review the methods employed in the estimation of nitrates, nitrites, and ammonia in sea-water, basing their criticisms on the results of experiments carried out with artificial solutions of known strength and with numerous samples of sea-water from various places on the coast of Holland. A. J. W.

Volumetric Estimation of Phosphoric Oxide by Uranium. FERNAND REPITON (*Chem. Zentr.*, 1907, ii, 2078; from *Mon. Sci.*, 1907, [iv], **21**, ii, 753—754).—A modification of Malot's cochineal process. Tincture of cochineal is prepared by boiling powdered cochineal with 100 c.c. of water for an hour, replacing the loss by evaporation, and heating again to boiling. When cold, 50 c.c. of alcohol are added, and the solution is filtered. The phosphate solution to be tested is mixed with 5 c.c. of sodium acetate solution, diluted to 100 c.c., heated to boiling, and mixed with a few drops of the indicator. Uranium solution is then run in until the solution, after first turning dark and then brick-red, changes suddenly to dull green. In order to make the necessary correction, an experiment is made by titrating under the same conditions a suspension of uranyl phosphate, when about 0·2—0·3 c.c. of uranium solution will be required to effect the change in colour. L. DE K.

Estimation of Carbon in Irons. LUCIEN L. DE KONINCK and E. VON WINIWARTER (*Bull. Soc. chim. Belg.*, 1908, **22**, 104—105).—It is proposed to burn the iron with lead borate in a current of oxygen, and to estimate the carbon dioxide formed by any suitable means. L. DE K.

New Experiences in the Simplified Method of Elementary Analysis. MAX DENNSTEDT (*Ber.*, 1908, **41**, 600—604. Compare Abstr., 1907, ii, 986).—The author gives a detailed account of the precautions to be taken in the analysis of difficultly combustible substances, of substances containing halogens or sulphur, and in the use of commercial calcium chloride and soda-lime. C. S.

Estimation of Potassium by the Perchloric Acid Method in Manures, Dung, Soils, and Vegetable Substances, &c. VINCENT SCHENKE (*Landw. Versuchs. Stat.*, 1908, **68**, 61—65. Compare Abstr., 1907, ii, 910).—The acid solution, to which sulphuric acid should be added if not already present, is evaporated and ignited at a low red heat, and the cold residue repeatedly rubbed and then digested with hot water and 2—3 c.c. of 5% hydrogen chloride. It is then washed into a measuring flask, heated, and treated with a very slight excess of 10% barium chloride. When the amount of barium sulphate is small, as in the case of straws and grain, filtration is unnecessary; phenolphthalein is added and then milk of lime, until strongly reddened, to precipitate phosphates, &c. After half an hour, an aliquot portion is acidified with hydrochloric acid, evaporated to a smaller volume, and treated with a suitable amount (5 c.c. or more) of 20% perchloric acid.

A number of determinations made by the above method are given, as well as by the less expeditious modification in which ammonia and ammonium carbonate are employed. Concordant results were obtained by the two methods, those by the lime precipitation method being, as a rule, slightly higher.

It is important to avoid adding more than a very slight excess of 10% barium chloride, and to employ only about 2 c.c. of 5% hydrochloric acid to dissolve the ignited substance. N. H. J. M.

Separation of Silver Chloride from Silver Iodide. HENRI BAUBIGNY (*Compt. rend.*, 1908, **146**, 335—336).—Whilst the method described by Hager (*Zeitsch. anal. Chem.*, 1871, **10**, 341) for the separation of silver chloride, iodide, and bromide from each other yields only approximately accurate results, the author finds that a modification of the method gives trustworthy figures if the chloride and iodide alone are present. The precipitate consisting of the two silver salts (chloride and iodide) is treated for a few minutes at a temperature of 70° to 80° with about 100 c.c. of a solution containing 100 grams of ammonium sesquicarbonate and 20 c.c. of 20% ammonia per litre. The mixture is then cooled, the clear solution is decanted on to a filter, and the residue is once more extracted with the ammoniacal solution. The residue, which now consists solely of silver iodide, is poured on the filter, washed with the ammoniacal solution diluted with an equal volume of water, dried, and weighed. The silver chloride is separated from the filtrate by the addition of nitric acid, and estimated in the usual manner. W. P. S.

Barium Arsenite and Arsenate. Leopold Rosenthaler (*Chem. Zentr.*, 1907, ii, 2078; from *Apoth. Zeit.*, 1907, **22**, 982).—Barium may be precipitated quantitatively by arsenious acid in the presence of ammonia, but not by arsenic acid unless sodium hydroxide is substituted for the ammonia.

Conversely, arsenious and arsenic acids may be precipitated quantitatively by barium chloride with addition of ammonia or of sodium hydroxide respectively. L. de K.

Electrolytic Analysis. Fritz Foerster (*Zeitsch. Elektrochem.*, 1908, **14**, 90—93).—A reply to Classen and to Fischer (this vol., ii, 226). T. E.

New Method of Qualitative Analysis of the Metals of the Second Group without using Hydrogen Sulphide or Ammonium Sulphide. Ettore Selvatici (*Boll. chim. farm.*, 1908, **47**, 73—79. Compare Tarugi and Schiff, Abstr., 1895, ii, 84).—The precipitation of the metals of the second group by means of hydrogen sulphide in presence of hydrochloric acid is only complete under certain conditions of acidity, temperature, and concentration, which cannot always be determined exactly. Further, cupric sulphide dissolves to some extent in ammonium sulphide solution, and mercuric and tin sulphides combine, giving a compound soluble in water and partly soluble in ammonium sulphide. In order to obviate these and other difficulties, the author recommends the following procedure, which involves the use of neither hydrogen sulphide nor ammonium sulphide.

The acid filtrate separated from the insoluble chlorides of the first group is treated with thioacetic acid, heated almost to boiling, allowed to cool, and filtered. After being washed on the filter, the precipitate is heated with concentrated nitric acid, which dissolves the sulphides of arsenic, lead (partly), bismuth, copper, and cadmium, and converts stannic and antimony sulphides into insoluble metastannic and antimonic acids and lead sulphide partly into sulphate. After filtration, the liquid is freed from excess of nitric acid by heating, and treated with excess of concentrated sodium hydroxide solution, which precipitates bismuth, copper, and cadmium as hydroxides, arsenic and lead remaining in solution; this precipitate is washed and dissolved in nitric acid, the bismuth being then precipitated as hydroxide by the addition of excess of ammonium hydroxide; the copper may be separated from the cadmium in the ammoniacal solution by means of hydrochloric acid and potassium thiocyanate, or of potassium cyanide and hydrogen sulphide. The addition of dilute sulphuric acid to the sodium hydroxide solution, containing the arsenic and lead, precipitates the latter, the arsenic remaining in solution. The metastannic and antimonic acids, mercuric sulphide, and lead sulphate are treated with alkaline ammonium tartrate to dissolve the lead sulphate, the insoluble residue being washed and dissolved in hot nitro-hydrochloric acid. The solution is then freed from excess of acid and of chlorine, and treated with hydrazine hydrochloride or sulphate to precipitate metallic mercury. The addition of zinc to the filtrate causes the precipitation of antimony and tin, the latter being separated by its solubility in hydrochloric acid. T. H. P.

Dry Lead and Silver Assays in Ores. JULIUS LOEVY (*Chem. Zeit.*, 1908, **32**, 220).—The Belgian method of fusing the sulphide in an iron crucible yields from 98—100% of the amount of lead regulus obtainable, whereas the English or German method, fusing with metallic iron in a Hessian crucible, yields from 92—95% only.

Any eventual loss in silver is not caused by evaporation during the cupelling process, but is due simply to the lead being deficient. When ores contain much zinc, low results are obtained even with the Belgian method. L. DE K.

Estimation of Copper in Pyrites. G. REMONDINI (*Chem. Zentr.*, 1907, ii, 2082; from *Mon. Sci.*, 1907, [iv], **21**, ii, 754).—Five grams of the sample are heated until the sulphur has been completely burnt, and the residue is boiled for fifteen to twenty minutes with 30—35 c.c. of nitric acid, D 1·4, the solution is diluted with water to 250 c.c., and 200 c.c. of the filtrate are neutralised with ammonia. After again acidifying with 5 c.c. of nitric acid, the copper is deposited electrolytically. L. DE K.

Technical Assay of Amorphous Carborundum. GABRIEL CHESNEAU (*Ann. Chim. anal.*, 1908, **13**, 85—89).—One gram of the finely-powdered sample is heated in a platinum crucible to redness for two hours in a muffle. This burns off the free carbon, and the residue is treated with 20 c.c. of pure hydrofluoric acid and 1 c.c. of sulphuric acid and slowly evaporated on a sand-bath. The mass is then boiled with hydrochloric acid and, after adding some hot water, the undissolved matter is washed by decantation with hot acid water, and finally collected on the filter and washed with hot water. It consists of pure carborundum (amorphous and crystalline), which is ignited and weighed. L. DE K.

Volumetric Estimation of Manganese in Iron and Steel. EDG. RAYMOND (*Bull. Soc. chim. Belg.*, 1908, **22**, 75—80).—The author again recommends a process published by him in 1883 and independently worked out by Hampe in 1885, based on the fact that manganese is precipitated as dioxide when its solution in nitric acid is heated with potassium chlorate. The dioxide is then estimated by dissolving it in an acid solution of ferrous ammonium sulphate and titrating the excess of the latter with standard permanganate.

When dissolving pig-iron in nitric acid for the purpose of a manganese estimation, it is advisable to remove the bulk of the silicon by means of a little hydrofluoric acid. The filtrate is then concentrated and boiled with potassium chlorate and nitric acid as usual.

L. DE K.

Estimation of Ferrous Iron. NICHOLAS KNIGHT (*Chem. News*, 1908, **97**, 122).—As has been stated by Mauzelius, when assaying native ferrous carbonate, such as siderite, by the Berzelius-Bunsen process (separation of the ferric from the ferrous iron by means of barium carbonate), it is of great importance that the mineral should be merely coarsely powdered. If reduced to a fine state of division, a not inconsiderable portion of the ferrous iron is oxidised to the ferric state; this is due, in part, to the heat generated by the friction, and also to the larger surface exposed. L. DE K.

Electrolytic Separation of Nickel and Zinc. FRITZ FOERSTER and W. TREADWELL, jun. (*Zeitsch. Elektrochem.*, 1908, **14**, 89).—In the separation of nickel and zinc from an ammoniacal solution containing sodium sulphite, the nickel deposited contains sulphur; the error due to this is usually between 1% and 2% of the weight of the nickel (compare Thiel and Windelschmidt, Abstr., 1907, ii, 601, 1137, and Foerster, *Zeitsch. Elektrochem.*, 1907, **13**, 563). T. E.

Rapid Electrolytic Separation of Nickel from Zinc. ARTHUR FISCHER (*Chem. Zeit.*, 1908, **32**, 185—186).—The author has accelerated the electrolytic deposition of nickel from ammoniacal solution by addition of sodium sulphite.

The solution should contain about 0·15 gram of nickel and zinc (as sulphates). As electrolytes are added 5 grams of ammonium sulphate 1—3 grams of sodium sulphite, and 30 c.c. of ammonia, D 0·91; the whole is then diluted to 250—300 c.c. The nickel may be deposited in twenty minutes if the following conditions are observed; as electrodes are employed two concentric cylindrical diaphragm-cathodes. Temperature 90—92°. The strength of the current to begin with is 1 ampere, which is gradually reduced to 0·1 ampere according to the potential; this is controlled by the author's compensation process described previously.

The zinc may be recovered by oxidising the solution with hydrogen peroxide, expelling the ammonia by heating, and adding 2—3 grams of tartaric acid and excess of alkali. The separation is complete in forty-five minutes when using a current of 2·5 amperes.

L. DE K.

Estimation of Nickel in the Presence of a very large Excess of Cobalt. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 89—91).—When applying the author's molybdate process (Abstr., 1907, ii, 818) to mixtures containing, say, 1 part of nickel to 20,000 parts of cobalt, it is necessary to remove first of all the bulk of the cobalt and then test for the nickel.

To the solution containing about 20 grams of the cobalt nitrate is added ammonium chloride and ammonia, and also an excess of hydrogen peroxide. The liquid is now neutralised with acetic acid, and a saturated solution of ammonium molybdate is added slowly until most of the cobalt is precipitated. The filtrate is evaporated to dryness, and the residue is moistened with nitric acid and heated to expel most of the ammonium salts; it is then dissolved in a few drops of nitric acid, and the nickel precipitated by means of an excess of ammonium molybdate as described in the previous article.

L. DE K.

Rapid Estimation of Potassium Dichromate in Milks. GOUÈRE (*Compt. rend.*, 1908, **146**, 291—292).—The ash from 10 c.c. of the sample is treated with 3 c.c. of 10% potassium iodide solution and 5 c.c. of hydrochloric acid, and the iodine liberated is titrated with sodium thiosulphate (5·06 grams per litre; 1 c.c. = 0·001 gram of potassium dichromate). No indicator is used. L. DE K.

Volumetric Estimation of Titanium. H. D. NEWTON (*Amer. J. Sci.*, 1908, [iv], 130—132).—The solution, which should contain not less than 10% of sulphuric acid, is placed in a flask fitted with a rubber cork through which pass a delivery tube and a small separating funnel. A sufficiency of pure zinc is added, and the whole is heated gently while a current of hydrogen is passed over the surface of the liquid. When the zinc has completely dissolved, the liquid is allowed to cool in the current of hydrogen, a sufficiency of ferric sulphate is poured through the funnel, and then sufficient air-free water to nearly fill the flask. The contents are transferred to a larger flask containing more air-free water, and the liquid is at once titrated with *N*/10 permanganate. One at. of iron = 1 at. of titanium. If the zinc is not free from iron, this should be allowed for. L. DE K.

Estimation of Small Quantities of Bismuth. HERBERT W. ROWELL (*J. Soc. Chem. Ind.*, 1908, **27**, 102—104).—In the process described, the bismuth is obtained in solution free from large quantities of lead, copper, tin, antimony, gold, and silver, then precipitated as oxychloride, and finally estimated colorimetrically as iodide in sulphuric acid solution. In the case of ores, mattes, &c., the sample is treated with hydrochloric and nitric acids, the silica is separated in the usual way, and the solution is evaporated with sulphuric acid to remove the hydrochloric acid and lead before being used for the estimation of the bismuth. For the estimation of bismuth in copper, 10 grams of the sample are dissolved in 60 c.c. of nitric acid (1 : 1), the solution is diluted with 150 c.c. of water, and saturated sodium carbonate solution is added until a slight permanent precipitate forms. One c.c. of the carbonate is then added in excess, the mixture is boiled for five minutes, and the precipitate, consisting of the whole of the bismuth and a little copper, is allowed to settle. The precipitate is then collected on a filter, washed, dissolved in hydrochloric acid, and precipitated as basic chloride. In the case of lead, base bullion, &c., 10 grams of the sample are dissolved in 20 c.c. of nitric acid, D 1·42, and 80 c.c. of water, the solution is boiled to precipitate most of the tin and antimony, and a little sodium chloride is added to precipitate the silver. The lead is precipitated by adding sulphuric acid to the boiling solution, and, after cooling for one hour, the lead sulphate is collected on a filter. The filtrate is treated with 5 c.c. of concentrated hydrochloric acid, a slight excess of ammonia is added, and then dilute hydrochloric acid until the solution is faintly acid in reaction towards methyl-orange. The solution is boiled, kept in a warm place for one hour, and the precipitate is collected on a filter and washed twice. The filtrate is tested with potassium iodide to ascertain whether it is free from bismuth. The filter and precipitate are now pulped with 10 c.c. of sulphuric acid (1 : 3), 30 c.c. of water are added, the mixture is boiled, cooled to separate any lead sulphate, and filtered, the residue being washed with dilute sulphuric acid. The whole, or a suitable portion, of the filtrate, containing possibly antimony, arsenic, tellurium, iron, and traces of lead, copper, or silver, and not more than 2 or 3 mg. of bismuth, is treated with 5 c.c. of sulphuric acid (1 : 3), 5 c.c. of 20% potassium iodide solution, and ten drops of sulphurous acid. The coloration obtained is compared with that produced by known amounts of bismuth. W. P. S.

Analyses of some Alloys and Slags. RODOLFO NAMIAS (*Chem. Zentr.*, 1907, ii, 2079—2080; from *Mon. Sci.*, 1907, [iv], 21, ii, 751—752).—*Estimation of Bismuth in Complex Slags.*—Two grams of the slag are fused with 10 grams of potassium hydroxide for twenty hours, the fused mass is dissolved in water acidified with nitric acid, and evaporated to dryness. The mass is taken up with nitric acid, D 1·2, and filtered off from the undissolved tin and antimony oxides and silica. The solution is then repeatedly evaporated with hydrochloric acid to expel the nitric acid, and the filtrate, now free from silver, and the bulk of the lead are treated with hydrogen sulphide. The precipitate after being washed with warm ammonium sulphide is redissolved in hot dilute nitric acid, and the lead is precipitated by adding 15% sulphuric acid up to 200 c.c. An aliquot part of the filtrate is then precipitated with ammonia, and the bismuth oxide collected, washed with ammoniacal water, ignited with the usual precautions, and weighed. The same process may be applied also to *alloys*, although traces of bismuth are frequently retained by the tin–antimony precipitate, from which they may be recovered by a second fusion with potassium hydroxide and subsequent treatment with nitric acid.

Estimation of Antimony in Slags.—The slags are fused with a mixture of 2 parts of potassium carbonate and 1 part of sulphur. The mass is dissolved in hot water, and the filtrate is boiled with hydrochloric acid and potassium chlorate; any undissolved matter should be fused again with the sulphur mixture. The antimony is then precipitated as usual by means of metallic iron. *Estimation of Tin*: another portion of the slag is fused with potassium hydroxide and then boiled repeatedly with nitric acid; the joint oxides of tin and antimony are collected, ignited, and weighed.

Estimation of Antimony in Alloys.—In the case of type metal and similar alloys, the finely cut up metal is boiled with dilute hydrochloric acid (1 : 1) and some potassium iodide, which dissolves the tin and lead and leaves the antimony undissolved. *Estimation of Tin*: the alloy is treated with nitric acid, and the joint amount of tin and antimony oxides is thus obtained.

Estimation of Tin in Slags and Ashes (*Ash of Dressed Silk*).—The sample is fused with potassium hydroxide and treated repeatedly with nitric acid; the result is tin oxide and silica, and the latter is then estimated in the usual way by fusion with alkali and evaporation with acid. L. DE K.

Estimation of Gold by means of Sucrose or Dextrose. P. LEIDLER (*Chem. Zentr.*, 1907, ii, 1867—1868; from *Zeitsch. Chem. Ind. Kolloide*, 1907, 2, 103).—Gold may be precipitated quantitatively by heating the solution on the water-bath with addition of sucrose or dextrose. Lactose cannot be used on account of the very finely-divided state of the precipitate. In the author's hands, the process gave satisfactory results with auric chloride and hydrogen aurichloride, but not with sodium aurichloride. Platinum solutions are not affected. Silver salts yield colloidal solutions. L. DE K.

Method for the Complete Analysis of Vegetable Substances. JACQUES M. ALBAHARY (*Compt. rend.*, 1908, **146**, 336—338).—A portion of the substance is dried at 100° to obtain the quantity of volatile matter (water, &c.), and is then incinerated to give the amount of total ash. A second portion of the sample is extracted with alcohol; the alcoholic extract is distilled at a low temperature, and the distillate is collected in a receiver containing a known volume of standard sodium hydroxide solution and surrounded by a freezing mixture. On titrating back the excess of sodium hydroxide, the quantity of volatile acids is obtained, and this added to the weight of the residue remaining in the distillation flask gives the weight of the alcohol-soluble substances. The sum of the substances soluble and insoluble in alcohol subtracted from the weight of the original material gives the actual amount of water present. The dried substance is utilised for the estimation of the fat, colouring matters, cholesterol, and lecithin. The portion of the substance insoluble in alcohol is next digested for two days in alcohol acidified with hydrochloric acid. The solution is then poured through a filter, and the residue is washed with alcohol. The filtrate and washings are evaporated, the residue is weighed, extracted with ether to remove organic acids, and then dissolved in water. Portions of the solution are used for the estimation of the reducing sugars, mineral acids, nitrogen, asparagine, sulphur, and ash. In the portion insoluble in acid-alcohol are estimated the total protein, nuclein, albumin, starch, cellulose, &c. W. P. S.

Estimation of Phenolic Hydroxyl Groups. JOHANNES HERZOG and V. HÂNCU (*Ber.*, 1908, **41**, 638—639).—The number of hydroxyl groups present in a phenol can be determined by condensing the phenol with diphenylcarbamyl chloride (Herzog, Abstr., 1907, i, 512), hydrolysing the urethane thus formed, and weighing the amount of diphenylamine formed. The hydrolysis is accomplished by heating 1 gram of the phenolic urethane with 8 c.c. of alcohol and an excess of potassium hydroxide in a pressure flask for one hour at 100°. The product is transferred to a flask and steam-distilled until the distillate is clear. Any diphenylamine which remains in the condenser tube is driven over by removing the water from the condenser and passing steam through the inner tube. After one or two days, the diphenylamine is collected on a dry filter paper, dried at 30°, and weighed. The results are mostly 1% too high.

Fairly good results were obtained with phenol, resorcinol, pyrogallol, eugenol, and *o*-nitrophenol. J. J. S.

Commercial Carbolic Acid and Disinfecting Powders. MEREDITH W. BLYTH (*J. Hygiene*, 1908, **8**, 83—91).—Phenol solutions used as a standard in the bacteriological testing of disinfectants should be made from freshly-distilled phenol. The actual quantity of phenols and cresols present in commercial carbolic acids and carbolic powders may be estimated by extracting the oils and testing their germicidal power. The comparative germicidal value of disinfectant powders may be estimated by keeping the powder and organism in contact by mechanical means during the whole period of the experiment. W. D. H.

Estimation of Picric Acid. MAX BUSCH and G. BLUME (*Zeitsch. angew. Chem.*, 1908, **21**, 354—356).—The process is based on the practical insolubility of nitron picrate in water. One hundred and fifty c.c. of the solution containing about 0·2 gram of any picrate are mixed with 1—2 c.c. of dilute sulphuric acid and heated just to boiling. Ten c.c. of nitron acetate (10% solution of nitron in 5% acetic acid) are added, and, when cold, the precipitate is collected on a Neubauer crucible, washed with 50—100 c.c. of cold water, dried for an hour at 110°, and weighed. The weight × 229/541 = picric acid.

Bromides, iodides, chlorides, chlorates, perchlorates, nitrites, nitrates, and chromates should be absent. L. DE K.

Differentiation between Arbutin and Quinol. P. LEMAIRE (*Ann. Chim. anal.*, 1908, **13**, 105—107).—When heated with ammoniacal silver nitrate, arbutin gives a beautiful silver mirror, whilst quinol is reduced rapidly in the cold. When heated with a solution of sodium hypobromite, arbutin gives a precipitate, whilst with quinol a passing blue coloration is noticed in the cold and also a precipitate which forms rapidly. A mixture of equal volumes of arbutin solution and sulphuric acid turns green on adding a few drops of 10% potassium dichromate solution, but quinol causes a brownish-black coloration. Arbutin gives a blue colour with ferric chloride, whilst quinol turns yellowish-brown, finally yielding a black, crystalline precipitate. When boiled with an equal volume of mercuric sulphate solution (5 grams of mercuric oxide, 20 c.c. of sulphuric acid, 100 c.c. of water), the liquid turns pale yellow, and on cooling gives a deposit; in the case of quinol, a yellowish-brown coloration is noticed. A mixture of arbutin solution with an equal volume of sodium hydroxide gives no coloration in the cold, whilst quinol turns yellowish-brown. An alkaline solution of arbutin turns pale yellow with sodium persulphate, whilst quinol turns reddish-brown. L. DE K.

New Reactions for Cholesterol and Oxycholesterol. L. GOLODETZ (*Chem. Zeit.*, 1908, **32**, 160).—Solid cholesterol turns blackish-brown when moistened with 1—2 drops of a mixture of 5 parts of sulphuric acid and 3 parts of 30% formaldehyde. Cholesterol turns blue when treated with a drop of liquefied trichloroacetic acid and a drop of 30% formaldehyde. Oxycholesterol when treated with a few drops of liquefied trichloroacetic acid turns at once green and shows, in the spectrum, a dark band in the red.

L. DE K.

The Sugar in Blood. LEONOR MICHAELIS and PETER RONA (*Biochem. Zeitsch.*, 1908, **8**, 356—359).—Parallel determinations were made of the sugar in the blood, using the electronegative kaolin and the electropositive ferric hydroxide for adsorption of the proteins. The results with the former substance were somewhat higher than those with the latter, and this has been shown to be due to the fact that the kaolin contained small quantities of a magnesium salt, which was precipitated as oxide with the cuprous oxide. With the polarimeter, the same results were obtained with kaolin as with ferric hydroxide.

S. B. S.

Use of Potassium Ferrocyanide and Zinc Acetate as Defecating Agents in Urine Analysis. CYRILLE CARREZ (*Ann. Chim. anal.*, 1908, **13**, 97—101).—A solution is prepared containing 150 grams of potassium ferrocyanide per litre and another one containing 300 grams of zinc acetate per litre. When a urine has to be tested for sugar with Fehling's solution or when the amount has to be determined polarimetrically, 50 c.c. of the sample are mixed first with 5 c.c. of the ferrocyanide and then with 5 c.c. of the zinc solution, and the filtrate is then tested as usual.

When the polariscope is employed, a second portion of 50 c.c. is treated in the same manner, but with a further addition of 25 c.c. of water. From the result of the two readings, the amount of dextrose is calculated as usual.

L. DE K.

Estimation of Lactose in Milk. GABRIEL GUÉRIN (*J. Pharm. Chim.*, 1908, **27**, [vi], 236).—Ten c.c. of the milk are treated with 92 c.c. of a solution containing 5 mg. of mercuric acetate and 2 mg. of glacial acetic acid. The mixture is poured on a filter, and the filtrate is shaken for a few moments with an excess of zinc dust and again filtered. The lactose in this filtrate is then estimated volumetrically with Fehling's solution. A correction is applied to the result obtained if the milk has undergone any decomposition; the acidity is estimated, and any excess over 165 c.c. of $N/10$ alkali solution per litre of milk is calculated into lactose and added to the quantity found previously. One c.c. of $N/10$ alkali is equivalent to 0·0088 gram of anhydrous lactose.

W. P. S.

Precipitation of Glycogen. EDUARD PFLÜGER (*Pflüger's Archiv*, 1908, **121**, 641—643).—Certain precautions in the method of filtering after the precipitation of glycogen by alcohol are described, the most important being that the supernatant fluid should have become quite clear before filtration is attempted, otherwise the finely-divided glycogen may pass through the filter.

W. D. H.

Estimation of Glycogen by Inversion with Acids. WILHELM GREBE (*Pflüger's Archiv*, 1908, **121**, 604—635).—The statement of

Nerking and Gatin-Gruzewska is confirmed that, by inversion with 2·2% hydrochloric acid and boiling for three hours, the maximum yield of sugar is reached. W. D. H.

A Colour Test for Formaldehyde and Benzoyl Peroxide. L. GOLODETZ (*Chem. Zeit.*, 1908, **32**, 245).—If a few particles of benzoyl peroxide are dissolved in 10—12 drops of sulphuric acid, a strong reaction takes place, accompanied by white fumes having the odour of benzophenone or fluorenone. If now a drop of dilute formaldehyde is added, the acid turns a permanent blood-red; this colour, however, is destroyed on adding water. The test is a very delicate one, and serves for the detection of either compound. L. DE K.

Estimation of Citral in Essence of Lemon. P. BRUYLANTS (*Ann. Chim. anal.*, 1908, **13**, 91—97).—The process is based on the fact that if alcoholic citral solution is added in sufficient quantity to a mixture of defibrinated (pig's) blood and yellow ammonium sulphide, the spectroscopic examination shows that the two bands of oxygenated hæmoglobin begin to fade and that a third band appears in the centre. A number of experiments have shown that the time this takes to form is inversely proportional to the amount of aldehyde present. It is therefore sufficient to prepare standard solutions of citral in lemon oil previously deprived of aldehyde by fractional distillation. Before use these are dissolved in aldehyde-free alcohol.
L. DE K.

Detection of Formic Acid. HENRY J. H. FENTON and H. A. SISSON (*Proc. Camb. Phil. Soc.*, 1908, **14**, 385).—See this vol., i, 243.

Estimation of the Acidity of Wine. GABRIEL GUÉRIN (*J. Pharm. Chim.*, 1908, **27**, [vi], 237).—The method described previously (Abstr., 1907, ii, 512) by the author gives results which are too low, owing to the fact that certain acid constituents of the wine are precipitated by the mercuric acetate employed. For instance, the number 11·4 found by the method corresponds with the number 12·5 of Gautier's alcohol-acid scale. W. P. S.

Estimation of Volatile Organic Acids in Tobacco. JULIUS TÓTH (*Chem. Zeit.*, 1908, **32**, 242—244. Compare this vol., ii, 238).—The distillation process gives unsatisfactory results. When tartaric acid is used, the distillate is actually alkaline. The following process gives good results; it is based on the fact that small quantities of oxalic acid are decomposed and expelled on repeated evaporation with water.

Three grams of the powdered sample are moistened with 3 c.c. of dilute sulphuric acid (1 : 5), and enough plaster of Paris is added to form a dry mass, which is then placed in a stoppered cylinder and kept in contact for forty-eight hours with 150 c.c. of anhydrous ether with frequent shaking so as to dissolve all the organic acids. Fifty c.c. of the ether are then withdrawn, and, after adding 20 to 40 c.c. of water, titrated with $N/2$ sodium hydroxide, using phenolphthalein as indicator; in the aqueous solution, the oxalic acid is then estimated. Another 50 c.c. of ether are taken, and evaporated to dryness; the residue is then evaporated thrice with addition of 50 c.c. of water. It is then dissolved in a little water, and titrated with *N*/2 sodium hydroxide, when the loss in acidity will represent the volatile acidity (acetic acid, &c.), including the oxalic acid. L. DE K.

Estimation of Fat and Unsaponifiable Matter in Tissues, together with a Critical Examination of the Methods now in Use. MUNEO KUMAGAWA and KENZO SUTO (*Biochem. Zeitsch.*, 1908, 8, 212—347).—The various methods in use for the estimation of fat (see later) produce, when tested on the same material, very varying results, and they have been subjected to a critical experimental examination. In all cases, the material employed was a specially prepared dried meat powder.

When the fat has been estimated by weighing the amount extracted by a given solvent, varying results have been obtained, depending on the solvent or solvents employed. An examination of the extractive power of different organic liquids was made, and it was shown that ethyl alcohol can produce the largest amount of extract. Putting the amount which can be extracted by this solvent as 100, the amounts extracted by other solvents can be represented by the following numbers: methyl alcohol, 99; ethyl acetate, 77; chloroform, 72; acetone, 62; benzene, 53; ethyl ether, 46; light petroleum, 45.

The examination of the alcoholic extract after it had been purified by solution in ether and filtration, showed that, besides fats, considerable quantities of other products were present, and the nitrogen in one case amounted to as much as 4·3%; the extract also contained phosphorus (compare Abstr., 1907, i, 371). Various methods were attempted for the separation of other substances extracted, but without success. It is found, however, that the higher fatty acids produced by hydrolysis can be readily obtained nearly pure by solution in light petroleum, in which the accompanying substances are insoluble. The true fats can therefore be estimated by weighing the fatty acids thus purified, which are produced by the hydrolysis of the alcoholic extract. It is found that a considerable part of the aliphatic acid produced by hydrolysis, that is not soluble in light petroleum, is lactic acid. The residue of the meat powder after extraction with alcohol yields on hydrolysis a certain quantity of higher fatty acid, which can also be purified by solution in light petroleum. It is proposed therefore to estimate the fat in tissues by determining the quantity of fatty acids obtainable by hydrolysis of the whole substance as follows.

Two to five grams of the dry tissue powder are warmed on the water-bath for two hours with 25 c.c. of 5*N*-sodium hydroxide (20 per cent.). The tissue readily dissolves. The mixture is then washed into a separating funnel and acidified with 30 c.c. of a 20% hydrochloric acid. The separated fatty acids are taken up with 70—100 c.c. of ether. The ethereal solution is filtered through asbestos, and the ether evaporated off at 50°. The residue thus obtained contains, in addition to fatty acids, colouring matters, lactic acid, and other substances. After thoroughly drying at 50° for some hours, 20—30 c.c. of light petroleum are added, when the impurities separate in a resinous form. The light petroleum solution is then filtered through asbestos, the solvent distilled off at 50°, and the residue dried at this temperature to constant weight. Analysis shows that it consists of almost pure fatty acids, and that it is practically free from phosphorus and nitrogen.

Comparisons were made of this method with those of Rosenfeld (extraction with alcohol and then with chloroform and weighing the combined extracts), of Dormeyer (digestion with pepsin, extraction of the digest with ether, and weighing ethereal extract), of Glikin (extraction with light petroleum), and of von Liebermann-Szekely (hydrolysis of tissue with sodium hydroxide, acidification, extraction of acids with light petroleum, and titration of an aliquot part of extract with sodium hydroxide). Rosenfeld's method gives results which are 17·4—46% too high, in spite of the fact that the residue of tissue after extraction with organic solvents still yields appreciable quantities of higher fatty acids on hydrolysis. The Pflüger-Dormeyer method gives results which are 16·7—40% too high. The Glikin method shows smaller inaccuracies, whilst in the von Liebermann-Szekely method, the principle of which is somewhat similar to the newly-proposed method, other than the higher fatty acids are estimated, and there are besides various minor inaccuracies.

It is claimed finally that it is not possible to estimate fats in tissues with absolute accuracy. The fatty acid number obtained by this method gives results, however, which compare favourably in accuracy with other indirect determinations, such as that of the proteins in tissues, determined by the nitrogen values, and the carbohydrates, determined by the copper reduction method.

The non-saponifiable matter can be determined by treating the fatty acids in petroleum solution with sodium hydroxide dissolved in absolute alcohol, and estimating the amount of substance remaining in the organic solvent after addition of water. S. B. S.

A New Reaction of Proteins. BRUNO BARDACH (*Zeitsch. physiol. Chem.*, 1908, **54**, 355—358).—If iodine is dissolved in an albumin solution in the presence of small quantities of acetone, the formation of iodoform is hindered, and, instead of the usual plates and stars, a precipitate of yellow needles is deposited after a varying lapse of time. The same reaction is given by various proteins, but its delicacy varies in different members of the group. W. D. H.

Physiological Assay of Digitalis Leaves. C. FOCKE (*Arch. Pharm.*, 1908, **245**, 646—656. Compare Ziegenbein, Abstr., 1903, ii, 118; Barger and Shaw, Abstr., 1904, ii, 793).—A 10% infusion of the powdered leaves is injected into the femoral lymph sac of *Rana temporaria*; the dose should be 1/50 of the body weight. The activity of the drug is then regarded as being inversely proportional to the average time required to stop the heart's action permanently in a series of frogs; this period should be seven to fifteen minutes. The frogs employed should weigh 20—35 grams, and during the experiment they should be cooled (down to 17°) in very hot weather, or warmed (up to 22°) in winter, so as to secure the optimum pulse rate of 48—60 per minute. It is only in this manner that uniform results can be obtained throughout the year. G. B.

General and Physical Chemistry.

Refractive Indices of Alcohol-Water Mixtures. LAUNCELOT W. ANDREWS (*J. Amer. Chem. Soc.*, 1908, **30**, 353—360).—Leach and Lythgoe (Abstr., 1905, ii, 655) have made determinations of the refractive powers of aqueous solutions of methyl and ethyl alcohols in which the concentrations were probably deduced from the densities. In the case of very strong alcohols, the refractometric and density constants bear such a relation to each other that the concentration may be much more accurately inferred from the former than from the latter, and it was therefore considered of importance that the refractive constants should be fixed independently of density measurements. The author has prepared absolute alcohol, and made the required solutions by diluting it with known weights of water.

The absolute alcohol was prepared in three ways: (1) the usual calcium oxide method, (2) by means of calcium, and (3) with magnesium amalgam. All these methods gave a product of the same density, refractive index, and critical solution-temperature.

Crismer's observation that the critical solution-temperature of alcohol in petroleum is the best criterion of its dryness is confirmed.

Absolute alcohol has D_4^{25} 0·78510 ± 0·00001, refractive index, μ, against air, 1·35941 ± 0·00001 at 25° on the hydrogen scale, and refractive powers, $(n_D-1)/d$, 0·45833 and $(\mu_D-1)/d$, 0·45779.

The refractive indices against air are recorded for alcohol containing from 0% to 30% of water, and the approximate temperature-coefficients of refraction are given throughout the same range. A maximum refractive index, 1·363315 at 25°, has been found for the mixture containing 20·7% of water, which corresponds closely with $3C_2H_5·OH,2H_2O$. E. G.

Refractive Power of Helium. KARL SCHEEL and RUDOLF SCHMIDT (*Ber. deut. physikal. Ges.*, 1908, **6**, 207—210. Compare Abstr., 1907, ii, 145).—The refractive index of helium has been measured for a series of wave-lengths by the interference method previously described. The dispersive power of helium is very small, and the index of refraction of helium at 14° for wave-lengths within the limits of the visible spectrum is found to be 1·0000340. This is appreciably smaller than the value given by Ramsay and Travers (1·0000362).

H. M. D.

Refraction and Dispersion of Helium. KURT HERRMANN (*Ber. deut. physikal. Ges.*, 1908, **6**, 211—216. Compare preceding abstract).—The refraction and dispersion of air, hydrogen, and helium has been measured by the interference method. As the source of light, a mercury arc lamp was used, and the following values are given for the refractive index of helium:

Wave-length.	Refractive index.
0·579μ 0·576μ	1·000034384
0·5461μ	1·000034525
0·4359μ	1·000035335.

H. M. D.

Abnormal Dispersion of Metallic Vapours. Franz Schön (*Chem. Zentr.*, 1908, i, 332; from *Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1907, **5**, 349—372, 397—436).—The vapour of alkali and alkaline-earth metals, thallium, gold, silver, and copper are shown to exhibit abnormal dispersion. The salts examined were vaporised in a carbon arc, a cold iron plate being introduced, whereby the flame was bent out and the typical anomalous dispersion observed. With the alkali metals, abnormal dispersion was only noticed with the lines of the principal series, the same being the case with copper, silver, and gold. The alkaline-earth metals show anomalous dispersion only in the case of a few lines, whilst magnesium, zinc, cadmium, and aluminium give normal dispersion. The calculated results confirm a formula derived from the electromagnetic theory of light. Concerning this, however, also the relation between the values of the constants found and the atomic weight of the metal, the original must be consulted. J. V. E.

Wave-length Tables of the Spectra of the Elements and Compounds. Sir Henry E. Roscoe, Marshall Watts, Sir W. Norman Lockyer, Sir James Dewar, George D. Liveing, Arthur Schuster, W. Noel Hartley, Wolcott Gibbs, Sir William de W. Abney, and Walter E. Adeney (*Brit. Assoc. Report*, 1907, **77**, 116—270).—A table of standard lines, and wave-length tables of the arc and spark spectra of iridium, osmium, and rhodium. T. H. P.

A Phenomenon Attributable to Positive Electrons in the Spark Spectra of Yttrium. Jean Becquerel (*Compt. rend.*, 1908, **146**, 683—685. Compare Abstr., 1906, ii, 317, 421; 1907, ii, 147; this vol., ii, 3, 78; Dufour, this vol., ii, 138).—The variation of the absorption bands in a magnetic field observed by the author in the cases of crystals, and solutions at low temperatures, of the rare earths, and by Dufour (*loc. cit.*) in the flame spectra of alkali-earth chlorides and fluorides, is also exhibited in the spark spectrum of yttrium. If, as is probable, the phenomenon is due to the presence of positive electrons, it follows that, although the positive electrons are so closely associated with the atom that they cannot be separated either by electric discharges or by radio-active phenomenon, they acquire sufficient mobility to manifest themselves in optical phenomena.

M. A. W.

Presence of Spark Lines in Arc Spectra. Charles Fabry and Henri Buisson (*Compt. rend.*, 1908, **146**, 751—754).—Spectroscopic examination of the arc between iron poles has shown (*Compt. rend.*, 1907, **144**, 1155) that this emits all the spark lines, but only from some parts of the arc. The arc produced between two vertical iron rods, 7 mm. in diameter, on visual examination appears to be formed of two flames, one proceeding from each electrode. The negative flame is much the more brilliant, and the difference is the greater for the radiations of the longer wave-length; thus, through a red glass the positive flame is almost invisible. In the ultra-violet, the lines given by the negative flame are widened, and a great many undergo reversal, but none of the lines are reversed by the positive flame. The flames seem to originate at a brilliant point situated on the fused drop of iron terminating each electrode. These brilliant points emit all the spark lines, but an anastigmatic spectroscope is required to distinguish their origin. For the smallest wave-lengths of the extreme ultra-violet, the arc spectrum and the spark spectrum are very different. The lines 2493, 2664, and 2684 are emitted only by the electrodes; the flame gives the lines 2679, 2689, and 2735, which are not strengthened at the poles, whilst 2395, 2413, and 2563, common to both, are strengthened at the electrodes.

The above properties are not peculiar to the iron arc, but are observed also with nickel and copper electrodes; the phenomenon has also been observed by Hartmann (*Astrophysical Journal*, 1903, **17**, 270) with magnesium. Lockyer considers that the production of spark lines in arc spectra is due to the very high temperature, but the authors believe that it is more probably the result of the rapid fall of potential occurring in the neighbourhood of the electrodes, and suggest that the essential condition for the emission of these rays is the existence of very rapid vibrations, caused in the present case by the electric field, and in other cases due to a thermal effect.

The emission of spark lines by the brilliant points on the electrodes explains their predominance when the conditions are such (immersion of the arc in water) that the intensity and length of the flames of the arc are diminished.

The arc between iron poles can also take another form, in which the brilliant point is observed only on the cathode and the anode flame has vanished. A considerable increase in the difference of potential between the electrodes occurs on passing from the first form of arc to the second.
E. H.

Change in the Hydrogen Spectrum under the Prolonged Action of Strong Electric Discharges. E. Rogovsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 37—41, *Phys.*).—After passing a strong discharge through a tube of hydrogen for several hours, the lines H_α, H_β, and H_δ disappear from its spectrum, many new lines and bands making their appearance, whilst the colour of the discharge changes from pink to light lilac.

When a tube through which a strong discharge has been passed is kept at rest for four months, the red and blue lines $\lambda = 656{\cdot}3$ and $486{\cdot}1$ $\mu\mu$, together with many other lines in the red, orange, and green, have disappeared from the spectrum, whilst some of the other lines in the blue which had at first disappeared now reappear. The photograph of the latter spectrum is given and is compared with an ordinary hydrogen spectrum.

The hydrogen spectra here described differ entirely from the secondary spectrum described by Dufour (Abstr., 1907, ii, 1). More probably they are the spectra to be expected for hydrogen from Goldstein's results for some of the alkali metals (Abstr., 1907, ii, 725).
Z. K.

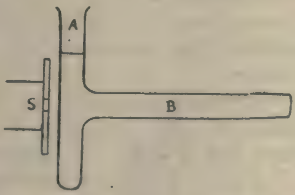
Band Spectrum of Calcium Fluoride. B. Walter (*Physikal. Zeitsch.*, 1908, **9**, 233—234. Compare Dufour, this vol., ii, 138).—Spectral observations with a Bremer arc lamp, the carbons of which contain calcium fluoride, show that the individual lines in several of the bands due to this substance are reversed. This is the case for the bands the centres of which are represented by the wave-lengths 6036·96, 6050·81, and 6064·49, whilst the band with its centre at 6087·24 is not reversed. These four bands are all of the same type, but reversion is also exhibited by the band with its centre at the wave-length 5290·94, which is of a different type. H. M. D.

Spectroscopic Study of Flames of Various Kinds. Gustave A. Hemsalech and Charles de Watteville (*Compt. rend.*, 1908, **146**, 748—751).—The method of studying flame spectra previously described (*Compt. rend.*, 1907, **144**, 1338; **145**, 1266) has been applied to the hydrogen flame. If the hydrogen before burning traverses an arc between iron rods, or, better, between an iron and a carbon electrode, the flame emits light, but is not uniformly luminous. The matter detached from the electrodes forms a cylindrical column, composed of threads of incandescent particles, which gives a continuous spectrum. In the latter, the ray 3860·03 of iron occurs very feebly, the three, 4030·84, 4033·16, and 4034·59, of manganese are just visible, and the calcium ray, 4226·9, appears extremely feebly. These rays probably proceed from impurities in the hydrogen. The external envelope of the flame emits only the calcium ray. If the arc is produced between calcium electrodes, the entire hydrogen flame takes an orange coloration, and besides the above rays, the green and red calcium bands are observed in its spectrum. The fact that in the case of iron the internal luminous column of the flame furnishes only a continuous spectrum, seems to support the theory that flame spectra are the result of chemical reactions. When the iron is present only in traces, as impurities in the burning hydrogen, addition of oxygen causes the appearance of some supplementary rays. This spectrum is probably composed of de Gramont's "ultimate rays" (Abstr., 1907, ii, 517). The authors have compared their spectrum with that of the star α-Cygni (Lockyer, 1902), giving a table showing the comparative intensities of the various lines in the two spectra, which show a certain resemblance. E. H.

Ultra-red Emission Spectra of the Alkali [Metals]. A. Bergmann (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 145—169. Compare this vol., ii, 242).—In this concluding part of the author's paper, an account is given of relative measurements in the ultra-red prismatic spectrum. It has been found that the majority of the lines are too weak for accurate determinations of the wave-lengths to be obtained from the diffraction spectrum, and the wave-length values have been obtained from observations on the prismatic spectrum, using an interpolation formula of the form $\lambda = A + B/(D - C) - KD^2$, in which λ is the wave-length, D the angular reading, and A, B, C, and K are constants.

The numbers of new lines which have been measured in the ultra-red region are for lithium, 2; sodium, 1; potassium, 9; rubidium, 8; cæsium, 10. With the exception of one cæsium line ($\lambda = 1377\ \mu\mu$), all the new lines fall into series, and for potassium, rubidium, and cæsium the existence of a new secondary series of lines is established. These new series exhibit relationships which are opposite in character to those of the series previously known, in that with increasing atomic weight of the alkali metal the new series lines are shifted towards the blue end of the spectrum. H. M. D.

Modified Spectroscopic Apparatus. Gregory P. Baxter (*J. Amer. Chem. Soc.*, 1908, **30**, 577—578).—1. In the examination of absorption spectra of dilute solutions in long tubes, the faintness of the spectra is often a great disadvantage. This difficulty is partly obviated by the use of a container made from a T of glass tubing of suitable diameter. The light passes through the tube B lengthwise, and is focussed upon the slit S by the solution in the tube A, which acts as a cylindrical lens, thus increasing the intensity of the light.



2. A simple fulgurator is readily constructed by fusing together, in a nearly parallel position by means of a small piece of glass rod, two glass tubes, into one end of each of which platinum wires have been sealed. One of the wires is bent in the form of a U, so that the end is directly below and parallel to the wire in the other tube. The end of the lower wire may be covered with a glass capillary in the usual way. The apparatus is dipped into the solution to be examined until the capillary is filled with solution. This system can be readily transferred from one solution to another, and can easily be rinsed into the vessel in which it has been used. W. H. G.

Influence of Temperature and Magnetisation on Selective Absorption Spectra. Henri E. J. G. du Bois and G. J. Elias (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **10**, 578—588).—The absorption spectra in the visible region of solid compounds of chromium, uranium, neodymium, and erbium, and of natural crystals of ruby and emerald, were examined at 18° and at −193°. The bands become narrower at the temperature of liquid air, in some cases becoming as sharp as the lines of sodium vapour. The effect of magnetisation in resolving the sharper lines was examined. C. H. D.

Absorption Spectra of Crystals of the Rare Earths and the Changes which they Undergo in a Magnetic Field at the Temperatures of Liquefaction and Solidification of Hydrogen. JEAN BECQUEREL and H. KAMERLINGH ONNES (*Compt. rend.*, 1908, **146**, 625—628. Compare this vol., ii, 78).—Previous observations relating to the influence of temperature on the absorption bands of tysonite and xenotime have been extended by measurements at −253° and −259°. The conclusion drawn from measurements between +100° and −190° that the width of certain bands of tysonite is proportional to the square root of the absolute temperature is found not to hold for temperatures between −190° and −259°. In this region the width of the bands decreases much less rapidly than would be the case if the above relationship held good. In the case of xenotime, two of the bands examined are wider at −259° than at −253°, and the width appears to have passed through a minimum at an intermediate temperature. This phenomenon is supposed to represent the general influence of temperature, there being for all bands a certain temperature for which the width of the band is a minimum.

Observations relating to the influence of temperature on the absorption bands observed in circularly polarised light are also recorded and interpreted in terms of the electron theory. H. M. D.

Infra-red Reflection Spectra. W. W. COBLENTZ (*Jahrb. Radioaktiv. Elektronik.*, 1908, **5**, 1—14).—A number of minerals have been studied by measuring the rays from a Nernst lamp reflected from a cleavage surface, and comparing them with those reflected by a silver mirror. The radiation was measured by means of a Rubens thermocouple.

Molybdenite, pyrrhotite, chalcocite, and covellite, and also magnetite, hæmatite, chromite, and zincite give continuous reflection. On the other hand, scheellite, wulfenite, rutile, and corundum show selective reflection, as do the silicates. Quartz, both in the crystalline and in the glassy form, shows selective reflection, which is different for the two modifications. In the absence of more definite knowledge respecting the constitution of the silicates, it is not possible to draw any conclusions as to the relation of the spectra to the structure of the silicic acids. C. H. D.

Examination of Liquid Crystals in Convergent Polarised Light. ERNST SOMMERFELDT (*Physikal. Zeitsch.*, 1908, **9**, 234—235. Compare Vorländer, Abstr., 1907, ii, 441, 442).—To demonstrate the pseudo-isotropic character of liquid crystals at the ordinary temperature, ammonium and potassium oleate may conveniently be used. The double refraction exhibited by the ammonium salt is about the same as that of the felspars. On account of the turbidity of potassium oleate, it could not be examined alone, but, when mixed with the ammonium salt, the double refraction observed with the latter was considerably increased, and it was possible to obtain a complete interference ring in the field of view with a mixture of the two oleates. H. M. D.

Rotatory Polarisation in Crystals which are not Enantiomorphous: Methyl Mesityloxidoxalate. ERNST SOMMERFELDT (*Jahrb. Min.*, 1908, i, 58—62).—Crystals of the polymeride of methyl mesityloxidoxalate ($[C_9H_{12}O_4]_2$) (Federlin, Abstr., 1907, i, 1006) are hemihedral-monoclinic, possessing a plane of symmetry, but no axis of symmetry. The optic axial plane is parallel to the plane of symmetry, and the axial angle is wide. The interference-figure shown in convergent polarised light, in the position when the vibration-directions of the plate coincide with those of the nicols, differs from a normal biaxial interference-figure in the absence of the dark bar perpendicular to the axial plane. Sohncke in his theory of crystal structure connected the rotatory polarisation of crystals with their enantiomorphous forms, but it has since been proved theoretically that certain classes of crystals which are not enantiomorphous may be circularly polarising. L. J. S.

The Mathematical Treatment of Photochemical Reactions on Thermodynamical and Electrochemical Basis. ALFRED BYK (*Zeitsch. physikal. Chem.*, 1908, **62**, 454—492).—In this theoretical paper the author deals with photochemical reactions in homogeneous systems, and develops the conception of a photochemical process as a special case of electrolysis by alternating current. This conception is based on the electromagnetic theory of light, and leads to formulæ which are in general harmony with what is known of photochemical processes, both in respect of reaction velocity and of equilibrium (see Luther and Weigert, Abstr., 1905, ii, 785), and do not presuppose the formation of intermediate compounds. In reversible photochemical reactions, according to the author's views, the change which takes place in the dark takes place all the same when the system is exposed to light; it is to be regarded as an electrically neutral process; on exposure to light, an extra reaction is induced, which is simply superposed on the former, and is to be regarded as of an electrolytic character. J. C. P.

Photochemistry. MAX TRAUTZ (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 169—194).—A theoretical paper in which photochemical change is considered from the standpoint of thermodynamics. It is shown that all the chief photochemical regularities can be deduced by the aid of the second law of thermodynamics. H. M. D.

Phototropy of the Fulgides and other Substances. HANS STOBBE (*Annalen*, 1908, **359**, 1—48. Compare Abstr., 1905, i, 857; 1906, i, 960).—Fulgides, containing aromatic substituting groups, undergo change of colour when exposed to light. Thus, triphenylfulgide, which forms pleochroic, orange-red, monoclinic crystals, becomes dark brown when exposed to sunlight or the rays of an arc lamp, changing again to its original colour in the dark. The brown and orange modifications are chemically identical, and differ only in the solid state. Such phenomena have been termed by Marckwald (Abstr., 1900, i, 2) phototropy. If this phototropic change is frequently repeated, the difference between the shades of the two forms becomes gradually less, a chemical change taking place which leads finally to the complete conversion of the fulgide into a new substance, the photo-anhydride. This slow photochemical reaction which accompanies the phototropic change is not reversible. The structure of the photo-anhydride will be discussed in a future communication. The present paper is a study of the nature of the phototropic change and the conditions under which it takes place.

To study the action of light waves of different lengths, the fulgide is exposed in a thin layer between two glass plates in a special spectrographic apparatus. Orange-yellow triphenylfulgide, when exposed to the light of the spectrum, after two minutes shows a broad, brown band between the spectrum lines E and G, which on prolonged exposure gradually extends towards the ultra-violet. If the whole layer of fulgide is first exposed to light under a cobalt or bluish-violet Jena glass light filter, it changes to blackish-brown and on exposure to the spectrum light becomes orange-yellow between the lines E and B, but brown from E towards the ultra-violet. Hence the yellow modification is sensitive to blue and violet light rays, but the blackish-brown form, which is intermediate between the yellow and brown modifications, is sensitive to yellow and red rays. The portion of the spectrum which causes the phototropic change from the yellow into the brown modification is termed the zone of stimulation (*Erregungszone*). The behaviour of a number of di- and tri-arylfulgides towards light rays of different wave-lengths has been studied in this manner, and the results obtained, of which those described for triphenylfulgide are typical, are tabulated and expressed graphically.

Phototropic change has been observed only with the lemon-yellow to orange-red diaryl- and the orange-red to dark red triaryl-fulgides ; the colourless alphyl- greenish-yellow to yellow-monoaryl-, and red, purple-red, or brown or tetra-aryl-fulgides are not phototropic.

The modifications of a phototropic substance can exist in the pure state only when exposed to light rays of the wave-length under the influence of which they are formed. Under all other conditions, the substance is a mixture or solid solution of the one form in the other. The phototropic change is caused by the light rays which are absorbed by the modification undergoing the change. Hence the brown form of triphenylfulgide must be in reality blue, the brown appearance resulting from its state of granulation. The equilibrium between the two modifications in a mixture depends on the wave-lengths of the light to which it is exposed. It follows that the parts of the spectrum which produce the phototropic change depend on the colour of the fulgide, the zone of stimulation lying the more towards the violet the deeper the normal shade of the substance, whilst the lighter the shade the further towards the ultra-red does the portion of the spectrum causing the reverse change extend, and that the amount of change in the colour of a phototropic fulgide not only increases with diminishing wave-lengths of the light rays and with increasing intensity of illumination, but diminishes with increasing temperature and depends, further, on the number and nature of the substituting groups, being greatest with diphenyl-*o*-methoxyphenyl-, diphenyl-piperonyl*allo*-, and diphenyl-*o*-nitrophenyl-fulgides, less with diphenyl-*p*-methoxyphenylfulgide, and least with the diaryl-fulgides. The furyl-fulgides resemble the phenyl compounds.

The phototropy of the fulgides is shown to be analogous to a number of other reversible reactions which take place under the influence of light, and is compared with the phenomena of fluorescence. As the phototropic modifications of the fulgides undergo the reverse change spontaneously in the dark, the energy of the light rays of short wave-length absorbed during the phototropic change might appear during the formation of the original form as heat or fluorescence. This, however, has not yet been observed.

The phototropy of other substances has been studied in a similar manner. The zone of stimulation for colourless β-tetrachloro-α-ketonaphthalene (Marckwald, *loc. cit.*) lies in the ultra-violet, whilst the reverse change is caused by yellowish-green or yellow rays. Red and blue rays have no action.

Phenylbenzylidenehydrazine, which forms light yellow crystals or a white powder, becomes red on exposure to violet or ultra-violet rays, becoming again colourless when exposed to yellow or green light. Phenylanisylidene- and phenylcuminylidene-hydrazines behave in the same manner, as do also osazones of the benzil series (Biltz and Wienands, Abstr., 1899, i, 910). Tetraphenyldihydrotriazine (Walther, Abstr., 1903, i, 582) and ethyl oxal*iso*butyrate (Wislicenus and Kiesewetter, Abstr., 1898, i, 240) have also been observed to exhibit phototropy. G. Y.

Simple Gas Burner Contrivance for Showing Various Flame Reactions, Combustion Phenomena, and Flame Colorations. WILHELM THÖRNER (*Zeitsch. angew. Chem.*, 1908, **21**, 673—677).—The ring by means of which the air supply of an ordinary Bunsen burner is regulated is replaced by a brass cylinder to which is fixed, at right angles, a brass tube, *A*. The air supply of the burner passes through this tube, consequently, if a U-tube or other suitable vessel be attached containing a volatile liquid, such as carbon disulphide or chloroform, or in which a gas, such as hydrogen sulphide or hydrogen cyanide, is being evolved, the combustion of these liquids or gases can be demonstrated. By making use of the methods of Riesenfeld and Wohlers (Abstr., 1906, ii, 593) or Beckmann (Abstr., 1907, ii, 209), the flame colorations of various substances can also be shown. A list of experiments which may be shown by means of this apparatus is given. W. H. G.

Experiments on the Secondary Rays of Radium. H. STARKE (*Ber. deut. physikal. Ges.*, 1908, **6**, 267—284).—It is found that γ-rays are not produced when the β-rays of radium are allowed to fall on substances such as lead, aluminium, and paraffin. The γ-rays of radium cannot therefore be considered as a type of Röntgen radiation resulting from the action of the β-rays on the substance of the radium. Absorption measurements which have been carried out with the secondary rays emitted by the action of β-rays on different substances, indicate that these are very heterogeneous, and that some of the component rays are much more readily absorbed than are the primary β-rays.

The secondary rays from paraffin are very easily absorbed; those from aluminium are less penetrating than the secondary rays from lead.

The most absorbable rays, both in the reflected and transmitted radiation, originate in layers of the material which are very close to the surface. In consequence of this, the transmitted radiation has a maximum intensity for a certain thickness of the material placed in the path of the β-rays, this thickness depending on the nature of the material.

The secondary rays, which originate from the action of the β-rays on air, are in all probability very readily absorbed. H. M. D.

Extraction of Polonium, and its Properties. Friedrich Giesel (*Ber.*, 1908, **41**, 1059—1062).—The lead chloride obtained from pitchblende is dissolved in water, and to the solution is added a little sulphuric acid to remove radium, and then ammonia. The precipitate is digested with a large excess of hydrochloric acid, the acid solution filtered off, and the lead chloride extracted four or five times with hydrochloric acid. Each extract is reduced to a small bulk, the lead chloride which crystallises out being removed; hydrogen sulphide precipitates a mixture of the sulphides of arsenic, lead, bismuth, copper, and mercury from the first extracts, whilst almost pure copper sulphide is obtained from the later extracts. The mixture of sulphides, after treatment with ammonium sulphide, is boiled with hydrochloric acid; the radium-*E* accompanies the bismuth, whilst the polonium remains with the copper sulphide. The latter is digested with nitric acid, and excess of ammonia added to the solution; the polonium separates as a slight, white, flocculent precipitate, which, when collected and dried on a filter, is obtained as a yellowish-grey film. This precipitate is far more active than any film of polonium hitherto obtained as a deposit on metal; it ozonises the air, which at the same time is seen to phosphoresce, and induces a beautiful phosphorescence on a zinc sulphide screen. The solution of the precipitate in 2 or 3 drops of hydrochloride acid is yellowish-brown; this colour, which is discharged on the addition of hydrogen peroxide or nitric acid, is not due to the polonium, but is probably connected with the presence of radium-*D*. No indication of the formation of helium from polonium during a period of two years was obtained. W. H. G.

Heating Effects produced by Röntgen Rays in Lead and Zinc. Henry A. Bumstead (*Phil. Mag.*, 1908, [vi], **15**, 432—437.* Compare Abstr., 1906, ii, 141).—The result previously obtained by the author (*loc. cit.*), that the quantities of heat produced in lead and zinc by Röntgen rays is as 2 : 1, is not confirmed by further experiments, which indicate that the quantities of heat are equal with an uncertainty of from 5% to 10%. The source of error in the previous experiments is traced to the imperfect heat insulation of the metals.

New experiments are described which show that the secondary rays emitted by lead exposed to the action of Röntgen rays are incapable of producing scintillations in a zinc-blende screen. Rays of the α-type are therefore absent.

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* *Amer. J. Sci.*, 1908, [iv], **25**, 299—304.

Other experiments show that the rate of change of the active deposit from thorium emanation is not altered by exposure to Röntgen rays.
H. M. D.

Anode Rays. V. E. GEHRCKE and O. REICHENHEIM (*Ber. deut. physikal. Ges.*, 1908, **6**, 217—225. Compare Abstr., 1907, ii, 421).—In continuation of previous investigations of anode rays, the authors have examined most closely the so-called "striction anode rays." Experiments with different forms of discharge tubes have shown the conditions under which such rays make their appearance. A convenient form consists of two bulbs of 10 cm. diameter with aluminium electrodes sealed through the walls at right angles to the axis joining the centres of the bulbs, these being connected by a tube which protrudes into each bulb to the extent of 2 cm. "Striction cathode rays" are at once seen when such a discharge tube filled with air or hydrogen is evacuated. If a trace of iodine vapour is added, "striction anode rays" also make their appearance. These anode rays are not influenced by a magnet.

Bromine, hydrogen chloride, bromide and iodide vapours also favour the formation of "striction anode rays," although the effect is much smaller than that observed when iodine is admitted to the tube containing hydrogen. The rays are not only produced in hydrogen and air, but also in oxygen and helium, whereas in nitrogen no positive results were obtained.

Measurements of the fall of potential at various points between the anode and cathode when "striction anode rays" are being produced indicate that the potential gradient in the anode ray region is very steep.

These facts indicate that the phenomena of discharge at the anode are very similar to the more closely-studied effects observable at the cathode.
H. M. D.

Anomalous Behaviour of Selenium. CHR. RIES (*Physikal. Zeitsch.*, 1908, **9**, 228—233).—The anomalous behaviour of crystalline selenium in regard to its electrical properties can be explained on the assumption that there are two different forms. The one form (α), obtained by heating amorphous selenium at temperatures below 200° for a considerable time and cooling rapidly, has a negative temperature-coefficient of electrical resistance. The temperature-coefficient of the second form (β) is within certain temperature limits positive, and this crystalline form of selenium is influenced by light in the opposite direction to that which characterises the α form. The β modification is obtained by heating amorphous selenium at temperatures above 200°. The product obtained by the various methods described for the preparation of crystalline selenium is characterised in terms of the author's theory.
H. M. D.

Contact Potential Differences Determined by means of Null Solutions. S. W. J. SMITH and H. MOSS (*Phil. Mag.*, 1908, [vi], **15**, 478—497).—Palmaer's conclusion from the results of experiments with drop electrodes (Abstr., 1907, ii, 424), that the true contact potential difference between mercury and 0·1*N* KCl solution is about 0·57 volt, is shown to be of doubtful validity.

Several so-called null solutions, for which the potential difference between still and dropping mercury electrodes in contact with the solution is zero, have been examined. A 0·26*N* solution of potassium cyanide possesses this property, and 0·1*N* solutions of potassium chloride, iodide, and hydroxide are convertible into null solutions by the addition of definite small quantities of sodium sulphide.

The potential differences between different null solutions and mercury are not the same. This is proved by measuring each potential difference against the potential difference Hg/0·1*N* KCl, and also by measuring one null solution against another. If the null solution potential differences are assumed to be zero, the values obtained for the potential difference Hg/0·1*N* KCl vary from about 0·53 to 0·79 volt. Assuming that the potential difference corresponding with maximum surface tension is most likely to be zero when the maximum is not depressed, it is probable that the potential difference Hg/0·1*N* KCl does not exceed 0·53 volt.

The equality between the polarising electromotive force required to produce the maximum surface tension between mercury and a given electrolyte and the electromotive force of the corresponding dropping electrode circuit no longer exists when the chemical action at the dropping electrode due to atmospheric oxygen becomes appreciable.

On the addition of small quantities of sodium sulphide to the solution, the potential difference between the dropping mercury electrode and 0·1*N* KCl remains unchanged, although the natural potential difference is thereby altered by more than 0·5 volt. The variation of the natural potential difference with increasing concentration of sodium sulphide is not uniform, but at a certain critical concentration the potential difference varies with extreme rapidity. H. M. D.

[Condition of Air which has been passed between Sparking Electrodes.] M. DE BROGLIE (*Compt. rend.*, 1908, **146**, 624—625).—The fact that flames, fed with air which has passed over metal electrodes between which a spark discharge is taking place, exhibit spectra of the metals has led the author to examine the condition of such air. It contains (1) ions of small mobility, (2) neutral centres which are converted into ions by the action of radium or Röntgen rays, and (3) attenuated solid particles which can be seen in the beam of an arc light. The cloud of solid particles is very dense in the case of sodium, thallium, and bismuth. The particles obtained from thallium electrodes have been found to show Brownian motion. These particles are the cause of the spectral reactions; some of them are electrically charged. H. M. D.

Hydrogen Peroxide Cell. HOWARD T. BARNES and G. W. SHEARER (*J. Physical Chem.*, 1908, **12**, 155—162).—In a previous paper (*Trans. Amer. Electrochem. Soc.*, 1907, **12**, 54), it was shown that a cell with magnesium and aluminium electrodes in contact with water containing dissolved air, gives an *E.M.F.* which slowly rises to about

1 volt, although the metals are close together in the potential series. This is now shown to be due to the formation of hydrogen peroxide by the action of water containing dissolved air on aluminium; the peroxide is detected by the potassium iodide starch test. When free hydrogen peroxide is added to the aluminium compartment of the cell, the *E.M.F.* rises to about 2 volts, but falls gradually as the peroxide is decomposed. In some of the experiments, a solution of aluminium sulphate was used as electrolyte.

The rate of change of the *E.M.F.* and current of the magnesium-aluminium cell after a time, and the effect of adding hydrogen peroxide, are described, and the effect of rise of temperature on the behaviour of the cell, with and without the addition of peroxide, has also been investigated.

Some other metals show a similar behaviour to that of aluminium in the above respect, but the effect is much smaller, and hydrogen peroxide cannot be detected. G. S.

Conductivity of Gaseous Mixtures at the Moment of Explosion. R. DE MUYNCK (*Bull. Acad. roy. Belg.*, 1907, 901—928).—The electrical conductivity of mixtures of carbon monoxide and air or oxygen at the moment of explosion has been measured. The explosion vessel consisted of a cylindrical brass tube, in the axis of which a copper wire was supported, this being insulated from the tube by ebonite. The tube and wire were connected through a galvanometer with the opposite poles of a battery of small cells, by means of which the conducting power of the gaseous mixture, when exploded by means of a spark, was determined.

For a given electrometric force, the galvanometer deflection was found to be much greater when carbon monoxide and oxygen are mixed in the proportion in which they combine than when the gaseous mixtures contain excess of oxygen. The conductivity is uni-polar in character, being considerably greater when the axial copper wire is connected with the positive pole of the battery than when the connexions are reversed. The galvanometer deflection for a given mixture increases with the pressure, but does not appear to depend much on the hygroscopic condition of the gases. An influence of the electrodes is apparent from the fact that larger deflections are obtained in the first explosion after the electrodes have not been used for some time than are met with in subsequent explosions. With increase in the applied difference of potential, the galvanometer deflection increases, and the relationship between deflection and voltage can be expressed by a linear equation. When the temperature of the explosion tube is raised, the conductivity of the explosion mixture increases considerably.

The experimental results are utilised in a discussion of the question as to whether the electrical conductivity is a direct result of the chemical action or is a secondary effect due to the development of heat which accompanies the explosion. It is calculated that one ion is produced for every 200 million molecules of carbon dioxide which are formed. This result favours the view that the conducting power of the exploded mixture is to be attributed to the heat liberated in the change. H. M. D.

Electrical Conductivity of Mixtures of Acid or Base and Water. G. BOIZARD (*Ann. Chim. Phys.*, 1908, [viii], **13**, 433—479. Compare this vol., ii, 251).—The author has studied the changes of conductivity, viscosity, and freezing point accompanying the addition of good or weak electrolytes to mixtures of good electrolytes with water. The results are briefly as follows.

With mixtures of good electrolytes with water, there are two concentrations, one high and the other low, between which the addition of a strong or weak electrolyte produces a diminution in the conductivity. These points of inversion depend on the temperature and, in certain cases, on the amount of electrolyte added. With good electrolytes without action on the solvent mixture, a condition of isoconductivity obtains at the points of inversion, the solution having the same conductivity as the solvent mixture. The increases or diminutions of conductivity produced in this way are referred to five principal types, the transition from one of these to another generally taking place in a perfectly definite order; these variations are functions of the temperature, and are not related to the corresponding variations of the viscosity and of the depression of freezing point.

Solutions of electrolytes in mixtures of sulphuric acid with water are stable, and the chemical equilibria attained are not functions of the time and undergo reversible variations when the temperature is changed. Further, the equilibrium depends only on the relative amounts of the ions present and not on the form in which these are introduced into the solutions.

On the basis of a simple theory concerning chemical or ionic equilibria in the solutions, formulæ are derived which lead to results agreeing with the experimental observations.

The changes taking place when sulphates, bisulphates, or acetates are added to mixtures of sulphuric acid and water are considered in detail.

T. H. P.

Equivalent Conductivity of the Hydrogen Ion derived from Transference Experiments with Nitric Acid. ARTHUR A. NOYES and YOGORO KATO (*J. Amer. Chem. Soc.*, 1908, **30**, 318—334).—In a paper by Noyes and Sammet (Abstr., 1903, ii, 126), an account was given of transference determinations made with *N*/20, *N*/60, and *N*/80 hydrochloric acid solutions at 10°, 20°, and 30°. The results when combined with the equivalent conductivity of the chloride ion gave a much higher equivalent for the hydrogen ion than that derived from the conductivity of acids at high dilutions. In order to ascertain the cause of this divergence, transference experiments have now been made with nitric acid at 20° with the following results:

Equivalent of HNO_3 per litre.	Transference number × 10^3.	Equivalent conductivity of hydrogen ion.
0·058	155·7	350·3
0·0184	159·6	340·2
0·0067	160·0	339·1
0·0022	162·8	332·2
0·0000	166·0	324·6

These values for the equivalent conductivity of the hydrogen ion, except at the highest concentration, agree closely with those obtained in the experiments with hydrochloric acid, and show that the value for the concentration intervals between 0·018*N* and 0·006*N* is nearly 5% greater than that derived from conductivity measurements at extreme dilution. This divergence has also been observed by Noyes and Sammet (*loc. cit.*), and has been confirmed by the conductivity determinations of Goodwin and Haskell and by the transference experiments of Jahn, Joachim, and Wolff. The conclusion is drawn that the transference number of the anion of acids, and therefore the ratio of the velocity of the anions to that of the hydrogen ion, is considerably greater at very low concentrations (0·001*N* or less) than at moderate concentrations (0·05—0·005*N*).

It is considered probable that this change of the transference number is due chiefly, if not entirely, to a retardation of the hydrogen ion at very high dilution. The nearly constant values of the equivalent conductivity of the hydrogen ion between concentrations of 0·006*N* and 0·018*N* are regarded as normal, whilst the variation at lower concentrations is thought to be due to some secondary effect of a general character.

In view of these results, it is suggested that in calculating the ionisation values of acids which are largely ionised at moderate concentrations, the observed equivalent conductivity of the acid should be divided by a Λ_0 value, obtained by adding to the equivalent conductivity of the anion that of the hydrogen ion obtained by the transference experiments at the given concentration. On the other hand, in the case of an acid solution in which the ion concentration is less than 0·001*N*, the older value (324 at 20° or 315 at 18°) for the hydrogen ion is to be preferred. E. G.

Conductivity and Ionisation of Salts, Acids, and Bases in Aqueous Solutions at High Temperatures. ARTHUR A. NOYES [with A. C. MELCHER, H. C. COOPER, G. W. EASTMAN, and YOGORO KATO] (*J. Amer. Chem. Soc.*, 1908, **30**, 335—353).—Noyes and Coolidge (Abstr., 1904, ii, 226) have described an apparatus for determining the electrical conductivity of aqueous solutions at high temperatures, and have recorded measurements made with solutions of sodium and potassium chlorides. The investigation has now been extended to other di-ionic salts, namely, silver nitrate, magnesium sulphate, sodium acetate, ammonium chloride, and ammonium acetate, to two tri-ionic salts, barium nitrate and potassium sulphate, and also to potassium hydrogen sulphate, hydrochloric, nitric, sulphuric, phosphoric and acetic acids, and sodium, barium, and ammonium hydroxides. In most cases, the measurements have been made at four or more different concentrations between 0·1*N* and 0·002*N*, and at temperatures ranging from 18° to 306°.

In the case of the di-ionic substances, the values of the equivalent conductivity for complete ionisation become more nearly equal as the temperature rises, and approach equality rapidly between 18° and 218°, but comparatively slowly at higher temperatures. Thus the specific migration velocities of the ions are more nearly equal the higher the temperature. Complete equality is not reached, however, even at 306°, but the divergence only exceeds 5% in the cases of hydrochloric acid, sodium hydroxide, and sodium acetate.

The equivalent conductivity of the tri-ionic salts increases steadily with the temperature, and attains values which are much greater than those for any di-ionic salt with univalent ions. Thus at 306° the value for potassium sulphate is 1·5 times that for potassium chloride.

The rate of increase in conductivity with all the neutral di-ionic salts is greater between 100° and 156° than between 18° and 100°, or between 156° and 218°, so that the temperature-conductivity curve is first convex, later concave, and then again convex towards the temperature axis with two intermediate points of inflexion. With acids and bases, however, and therefore with the hydrogen and hydroxyl ions, the rate of increase of the equivalent conductivity steadily decreases as the temperature rises, and the curve is consequently always concave towards the temperature axis. In the case of the tri-ionic salts, the rate of increase steadily grows, owing to the great increase in the equivalent conductivity of the bivalent ion, and hence the curve is always convex towards the temperature axis.

With regard to the variation of the equivalent conductivity, Λ, with the concentration, C, of solutions between $0·1N$ and 0·002 or $0·0005N$, the results for all temperatures with all the salts, both di- and tri-ionic, and also with hydrochloric acid, nitric acid, and sodium hydroxide, can be expressed by the function $C(\Lambda_0 - \Lambda) = K(C\Lambda)^n$, if to n is assigned a value (varying with different substances) between 1·40 and 1·55. It is evident that if the conductivity ratio, Λ/Λ_0, can be taken as a measure of the ionisation, γ, the latter changes with the concentration in accordance with the function $(C\gamma)^n/C(1-\gamma) =$ a constant, in which n has values varying between 1·40 and 1·55.

It has been pointed out previously (Noyes, *Congress. Arts. Sci.*, St. Louis Exhibition, 1904, **4**, 317) that at the ordinary temperature the form of the functional relation between ionisation and concentration is the same for salts of different ionic types. The present results show that this is true also at high temperatures, and that even the large variation of temperature and the consequent change in the character of the solvent affect very slightly, if at all, the value of the exponent in this empirical relation. This affords a confirmation of the view that the form of the concentration function is independent of the number of ions into which the salt dissociates, and shows that chemical mass action has not any appreciable influence in determining the equilibrium between the ions and the non-ionised part of largely dissociated substances. The functions $\Lambda_0 - \Lambda = KC^{\frac{1}{3}}$ and $\Lambda_0 - \Lambda = K(C\Lambda)^{\frac{1}{3}}$ also express the results with potassium chloride, sodium chloride, hydrochloric acid, and sodium hydroxide up to 218° between $0·1N$ and 0·002 or $0·0005N$.

The equivalent conductivity and ionisation of acetic acid and ammonium hydroxide change with the concentration at all temperatures, even up to 306°, in accordance with the law of mass action. Phosphoric acid has intermediate values of n (1·8—1·9) which approach more nearly to the theoretical value (2·0) than to the empirical value. In general, the ionisation decreases steadily with rise of temperature in the case of every substance investigated, and the decrease is nearly the same for all largely ionised salts of the same ionic type.

It is shown that the effect of temperature on the ionisation of salts is comparable with its effect on the dielectric constant of water.

Neutral salts of the same ionic type are ionised to nearly the same extent in all cases. Hydrochloric acid (up to 156°), nitric acid, and barium and sodium hydroxides also conform to this principle, although their ionisation is somewhat greater than that of the corresponding salts.

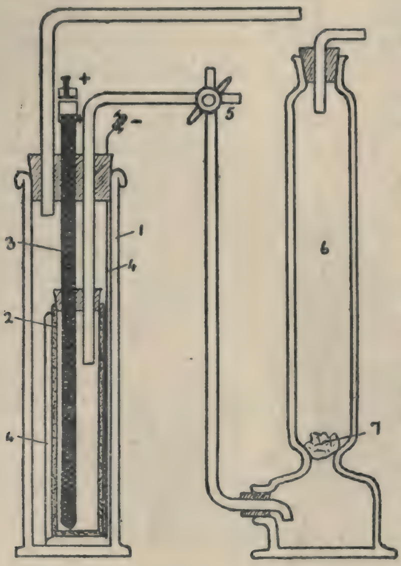
The rough proportionality which exists at the ordinary temperature between the non-ionised part of a salt and the product of the valencies of its ions has now been proved to persist up to high temperatures.

The ionisation constant for ammonium hydroxide increases considerably from 0° to 18°, then remains nearly constant to 50°, and afterwards rapidly decreases, until at 306° its value is only 1/200 of that at 18°. The values for acetic acid are similar to those of ammonium hydroxide at all temperatures. Phosphoric acid has a much greater ionisation constant, which decreases steadily and rapidly with rising temperature.

From these results, the conclusions are drawn that the ionisation of salts, strong acids and bases is primarily determined, not by specific chemical affinities, but by electrical forces arising from the charges on the ions; that this is not affected, except in a secondary degree, by chemical mass action, but is regulated by general, comparatively simple laws; and that, in most respects, the phenomenon differs from that of the dissociation ordinarily exhibited by chemical substances, including that of the ionisation of weak acids and bases. E. G.

Determination of Ionisation Factor of Water in Hydrochloric Acid Solutions. EMMANUEL DOUMER (*Compt. rend.*, 1908, **146**, 687—690. Compare this vol., ii, 252).—In an earlier paper, the author has defined the ionisation factor of water in solutions of hydrochloric acid as the ratio $2v/V$, where v and V represent the volumes of oxygen and hydrogen respectively obtained during the electrolysis of the solution; and in the present paper methods are described whereby the value of v can be determined accurately. For this purpose, electrodes of silver or mercury are used; in the former case, after the anode has become coated with brown silver oxide, it absorbs all the chlorine and all the electrolytic oxygen is evolved, and in the latter case the mercury anode absorbs both the oxygen and the chlorine, and from the increase in weight of the mercury and the volume of hydrogen liberated at the cathode the weight of electrolytic oxygen and of chlorine can be calculated after making the necessary correction for the trace of mercury oxide dissolved by the solution. The results of the experiments tabulated in the original show that the ionisation factor of water in hydrochloric acid solutions is a constant, and independent of the intensity of the current, of the strength of the solution, and probably also of the nature of the anode; the factor is equal to 0·662, whence it follows that, in the electrolysis of solutions of hydrochloric acid, about two-thirds of the hydrogen evolved comes from the electrolysis of the water, and the remaining one-third from the hydrochloric acid. M. A. W.

Apparatus for the Quantitative Electrolysis of Hydrochloric Acid. J. B. Lewis (*J. Amer. Chem. Soc.*, 1908, **30**, 615—616).—The apparatus consists of (1) a glass cylinder, (2) a porous pot, (3) a carbon anode, (4) a cathode of sheet platinum, fitted together as shown in the sketch. The chlorine delivery tube is connected to the bottom of the tall cylinder (6), the top of which is provided with an air outlet; a loose plug of cotton wool (7) is placed in 6 to retard the mingling of chlorine and air. A two-way stopcock is interposed as shown at 5. The air (or chlorine) and hydrogen evolved during the electrolysis may be collected over water in inverted burettes. To start the apparatus, the anolyte is saturated with chlorine by adding a few crystals of potassium chlorate to it. The mixture may then be used immediately; electrolysis need only be carried on a minute or two, during which time the chlorine is allowed to escape by means of the stopcock 5, and then the apparatus is ready for the demonstration. W. H. G.



Electrolytic Valve Action of Columbium and a Classification of the Behaviour of Electrolytic Anodes. Günther Schulze (*Ann. Physik.*, 1908, [iv], **25**, 775—782).—The electrolytic valve action of columbium is studied in the same way as that of tantalum (*ibid.*, 1907, [iv], **23**, 226. Compare also Abstr., 1907, ii, 842). The results obtained with the two metals are very similar. A classification of anodes is given according to whether they are attacked or not, and whether the product of reaction is soluble, insoluble, a conductor or not, forms an adherent film, &c. The anodes which exhibit valve action are supposed to belong to the class in which a non-conducting, porous skin is formed and simultaneously gas is evolved; the gas film retained in the pores of the skin is the non-conductor to which the valve action is due. T. E.

Electrolytic Reduction of Solutions of Titanic Sulphate. B. Diethelm and Fritz Foerster (*Zeitsch. physikal. Chem.*, 1908, **62**, 129—177).—The only result of the electrolytic reduction of titanic sulphate in sulphuric acid solution is to reduce the metal from the quadrivalent to the tervalent condition (compare Knecht's experiments on the chloride, Abstr., 1903, ii, 217). The course of the reduction varies with different electrodes, the current efficiency being considerably higher with a lead or a copper electrode than with one of bright platinum. In all these cases the reduction goes on until it is complete. With an electrode of platinised platinum, whilst the current efficiency is high, the reduction may be incomplete.

It appears from a study of the potentials at an electrode immersed in a solution containing titanium in both stages of oxidation, that such a solution is in equilibrium with hydrogen at atmospheric pressure. In contact with platinised platinum, the equilibrium $Ti^{\cdot\cdot\cdot\cdot} + H \rightleftarrows Ti^{\cdot\cdot\cdot} + H^{\cdot}$ is reached from either side.

The cathode potentials and the way in which they vary with the current density have been studied in detail for the reduction which takes place without the evolution of hydrogen. Here, again, the influence of the material of the cathode is very evident.

The velocity of the reduction of titanium sulphate is much smaller at a bright platinum cathode than at a platinised platinum cathode. The effective reducing agent at lead cathodes is electrolytically separated, finely-divided lead, and at copper cathodes apparently an alloy of copper and hydrogen.

The influence of the cathode material recorded in this paper is analogous to that observed by Chilesotti in the electrolytic reduction of molybdic acid (Abstr., 1906, ii, 263, 365), and to that observed by Haber and Russ in the reduction of organic substances (Abstr., 1904, ii, 309).

Electrolytic reductions which involve a change of valency appear to depend on the secondary action of the hydrogen which is primarily separated at the cathode surface, or of the electrolytically separated metal. Such a direct loss of charge as represented by

$$M^{(n+1)+} + - \longrightarrow M^{n+}$$

does not correspond with what usually happens. J. C. P.

Thermal Conductivity of Mixtures of Argon and Helium. Johannes Wachsmuth (*Physikal. Zeitsch.*, 1908, 9, 235—240).—The thermal conductivity of various mixtures of argon and helium has been measured according to the method of Schleiermacher. The experimental data are discussed in reference to the formula $k = f.\eta.C_v$, in which k denotes the thermal conductivity, η the coefficient of viscosity, and C_v the specific heat at constant volume. Previous experiments have shown that the value of f for argon and helium is 2·5, in accordance with the Maxwell-Boltzmann theory. For mixtures of these two gases, the value of f is, however, not constant, and the curve which represents f as a function of the composition of the gas mixture exhibits a maximum for the mixture containing 60% helium. This corresponds with the results of previous measurements of the thermal conductivity of hydrogen-oxygen mixtures, the maximum value of f in this case being obtained for the mixture containing 60% of hydrogen. The variation in the value of the factor f in the gas mixtures is attributed to the alteration in the mean free path of the molecules of a gas which takes place when this is mixed with a second gas. An interpolation formula is deduced by taking account of this alteration in the mean free path, from which the thermal conductivities of mixtures of argon and helium can be calculated in good agreement with the observed values. H. M. D.

Specific Heat and Dissociation of Chlorine. Mathias Pier (*Zeitsch. physikal. Chem.*, 1908, 62, 385—419).—The molecular specific heat of chlorine, according to the work of earlier investigators, is about 2 cal. greater than that of most diatomic gases. This might be connected with the abnormal density of chlorine, and accordingly the author has studied the behaviour of this gas at various temperatures and pressures. If the value 2·49 (air = 1) is taken as the correct density at 0° and 1 atmosphere pressure (see Moissan, Abstr., 1904, ii, 114), then under the same pressure the densities at higher temperatures are as follow: 50·24°, 2·4688; 100·4°, 2·4601; 150·7°, 2·4554; 184·0°, 2·4538. When the pressure is reduced to about 0·1 atmosphere, the theoretical value of the density, namely, 2·4494, is reached; the variation of density with pressure at 13·5° is shown by the following figures, the first number given in each case being the pressure in atmospheres; 1·00, 2·4820; 0·466, 2·4640; 0·294, 2·4584; 0·195, 2·4543; 0·123, 2·4518; 0·0569, 2·4494.

As to the influence of the abnormal density of chlorine on its specific heat, the assumption is made that there is a partial association to Cl_4 molecules. On this assumption a formula is based, which gives the variation of density (Δ) with the pressure (P atmospheres) and with the absolute temperature. With this formula, which runs: $\log(\Delta - 2{\cdot}4494) = 463{\cdot}11/T - 0{\cdot}6415 - \log T + \log P$, it is possible to calculate the density of chlorine in very good agreement with the values actually found at various pressures and temperatures.

From the foregoing formula, the author calculates also the correction which must be applied to the molecular specific heat of chlorine to get the value for the ideal undissociated gas; the correction, however, amounts, even at the ordinary temperature, only to 0·3—0·5 cal., and hence the exceptionally high value of the specific heat of chlorine cannot be attributed to its abnormal density.

The degree of association of chlorine is practically zero at 300°, and from this temperature up to 1450° the density is normal. This is shown by a study of the specific heat. Hydrogen and chlorine were exploded in a bomb (1) with an excess of chlorine, and (2) with an equivalent excess of hydrogen. From the maximum pressure produced by the explosion, the maximum temperature reached was calculated, and from the data obtained in the two cases the specific heat of chlorine was compared with that of hydrogen. Regnault's value for the specific heat of chlorine is distinctly too high, and the author finds that up to 1450° the experimental values are satisfactorily given by the formula $C_v = 5{\cdot}431 + 0{\cdot}0005T$. The values so obtained, however, are still greater than those of most diatomic gases, for which the formula $C_v = 4{\cdot}327 + 0{\cdot}0005T$ is valid.

Above 1450°, the experimental values for the specific heat of chlorine are considerably greater than those calculated by the foregoing formula. On the basis of the difference between these values, and on the assumption that the heat of dissociation of the chlorine molecule is −113000 cal., the author, applying Nernst's theory (Abstr., 1906, ii, 727; see also Brill, Abstr., 1907, ii, 233), deduces the formula $\log(1-x^2)/x^2 = 113000/4{\cdot}571T - 1{\cdot}75\log T + \log P - 3$ as applicable to chlorine above 1450°. In this formula, x is the degree of dissociation of the chlorine. J. C. P.

Specific Heat of Some Elements and Salts between the Temperature of Liquid Air and Room Temperature. PAUL NORDMEYER (*Ber. deut. physikal. Ges.*, 1908, **6**, 202—206. Compare Abstr., 1906, ii, 521; 1907, ii, 432).—The specific heat values recorded for certain elements in the previous paper (*loc. cit.*) have been confirmed. For the other substances examined, the following mean specific heats were deduced: aluminium, 0·182; phosphorus (yellow), 0·178; potassium, 0·169; potassium bromide, 0·102. H. M. D.

Vapour Pressure of Dry and of Ordinary Sal Ammoniac. JOHANNES J. VAN LAAR (*Zeitsch. physikal. Chem.*, 1908, **62**, 194—198). —Treating this problem from the point of view of thermodynamics, the author shows that the conclusions drawn by Abegg (this vol., ii, 157) and Johnson (*ibid.*) are incorrect. It does not follow that the partial pressure of undissociated ammonium chloride above sal ammoniac must always be the same at a given temperature, whatever be the degree of dissociation of the vapour. In the case of ordinary sal ammoniac, a complete dissociation equilibrium is established; this is not so with dry sal ammoniac, and the theory of heterogeneous dissociation equilibria is therefore not applicable to this case. Such dissociation equilibria are defined, not by the *partial pressure* of the undissociated substance, but by the *total pressure* of the system.

J. C. P.

Vapour Pressure of Aqueous Acetone Solutions. A. E. MAKOVETZKI (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 216—227).—The object of the research was to study complex solutions, but the difference in vapour pressure of acetone and water is so great that the study of the systems acetone + water + a third substance was abandoned. Curves and tables are given showing the relation between the composition of the solutions and the refractive index at various temperatures, the vapour pressure of the solutions, and the partial vapour pressures of acetone and water respectively.

The results are claimed to be considerably more accurate than those of previous investigators (compare Taylor, Abstr., 1900, ii, 529). Z. K.

Condition of Substances in Absolute Sulphuric Acid. GIUSEPPE ODDO and E. SCANDOLA (*Zeitsch. physikal. Chem.*, 1908, **62**, 243—255).—The authors have discovered independently the method of preparing absolute sulphuric acid lately described by Hantzsch (this vol., ii, 14), and the value they find for the freezing point is 10·43°. In the Beckmann apparatus used, the tube is closed by a glass stopper, into the central passage of which the thermometer is ground; another small tube sealed into the stopper is closed at its upper end by a plugged piece of thick-walled rubber tubing, in the wall of which a hole is pierced for the passage of the platinum stirrer; with the aid of a little grease, the stirrer moves easily and the acid is protected from the air.

Experiments with phosphoryl chloride and sulphuryl chloride as normal solutes give 68·07° as the mean value for the molecular freezing-point depression in absolute sulphuric acid. When the value for the latent heat of fusion of sulphuric acid (24·03°) found by Pickering is inserted in the formula $K = 0{\cdot}02T^2/\lambda$, K is calculated to be 66·86°, a figure in better agreement with the authors' experimental determination than with Hantzsch's value (70°).

The numbers obtained for the molecular weight of water in absolute sulphuric acid are about two-thirds of the normal value, even in solutions considerably more concentrated than those examined by Hantzsch. Using pyridine and quinoline as solutes, the authors show that acid sulphates give a figure for the molecular weight which is half the normal value, and not two-thirds as found by Hantzsch. The conclusions based by the latter on his experiments, and his "hydronium" theory in particular, are adversely criticised.

J. C. P.

Heats of Vaporisation of the Liquid Halogen Hydrides and of Hydrogen Sulphide. P. H. ELLIOTT and DOUGLAS MCINTOSH (*J. Physical Chem.*, 1908, 12, 163—166).—The heats of vaporisation of the compounds in question were determined by an electrical method (compare Franklin and Kraus, Abstr., 1907, ii, 929). The mean values (from three to four experiments for each substance) are 14·9, 17·3, 18·8 and $19{\cdot}6 \times ^{10}$ ergs. per gram-molecule for hydrogen chloride, bromide, iodide and sulphide respectively. The results agree well with those calculated from the variation of the vapour pressure with temperature by means of the Clausius equation, except in the case of hydrogen iodide, for which the calculated value is $20{\cdot}7 \times 10^{10}$ ergs.

G. S.

Heat of Formation of Organic Fluoro-compounds. II. FRÉDÉRIC SWARTS (*Bull. Acad. roy. Belg.*, 1907, 941—955. Compare Abstr., 1907, ii, 9).—The heats of combustion of the aromatic fluoro-compounds named below have been determined. The three numbers placed after the name of each compound are the heat of combustion at constant volume, the heat of combustion at constant pressure, and the heat of formation (large calories): fluorobenzene, 746·26, 746·84, 7·26; *o*-fluorotoluene, 901·61, 902·47, 14·73; *p*-fluorotoluene, 901·86, 902·72, 14·48; fluoro-ψ-cumene, 1206·15, 1207·49, 36·51; *o*-fluorobenzoic acid, 739·92, 739·92, 108·38; *m*-fluorobenzoic acid, 737·36, 737·36, 111; *p*-fluorobenzoic acid, 739·43, 739·43, 108·87.

The mean difference between the heats of formation of the above fluoro-compounds and the corresponding hydrogen compounds is approximately 14. This is considerably smaller than the mean difference of 20, which was obtained on comparing the heats of formation of aliphatic fluoro-compounds with the corresponding hydrogen compounds. The smaller difference corresponds with the greater chemical activity of nuclear substituted fluorine.

The above three heat values have also been determined for ψ-cumene; these are respectively 1244·48, 1246·5, 16·24. The difference between the heat of formation of solid fluoro-ψ-cumene and liquid ψ-cumene is greater than 20 Cal. H. M. D.

Heat of Formation of Quadrivalent Oxygen Compounds. Douglas McIntosh (*J. Physical Chem.*, 1908, **12**, 167—170).—The amounts of heat given out when methyl alcohol, acetone, and ethyl ether are mixed with liquid hydrogen bromide have been measured. The apparatus used consisted of a Dewar test-tube nearly filled with liquid hydrogen chloride, in which was immersed a small tube containing liquid hydrogen bromide. In the upper part of the latter tube was a bulb containing a known weight of the organic liquid, which was ultimately dropped into the hydrogen bromide, the mixing being effected by an electrical stirrer. The whole apparatus was placed in a vacuum tube containing solid carbon dioxide and ether. From a comparison of the rate of "natural" evaporation of the hydrogen chloride with that after admixture, and the known heat of vaporisation of hydrogen chloride (preceding page), the heat given out in the reactions has been calculated.

The mean heats of combination of 1 mol. of the organic compounds with hydrogen bromide are as follows: Methyl alcohol, 57×10^{10} ergs.; acetone, 60×10^{10} ergs.; ether, 95×10^{10} ergs., but the agreement between different observations, especially in the last case, is only moderate.

It is considered that the heat developed is due mainly, if not entirely, to chemical combination, but the evidence in that respect is not conclusive. G. S.

Simple Demonstrations of the Gas Laws. William M. Dehn (*J. Amer. Chem. Soc.*, 1908, **30**, 578—582).—Some simple forms of apparatus are described, involving the use of a moving drop of mercury (compare Abstr., 1907, ii, 755), by means of which the effects of heat, pressure, and aqueous vapour on a gas, separately and conjointly, may be demonstrated and calculated.

Charles' Law.—The apparatus consists of a calibrated bulb joined to a graduated stem, the internal diameter of which is less than 3 mm., containing a drop of mercury. A length of rubber tubing is attached to the end of the stem, and the apparatus, except the end of the rubber tube, is then placed in a water-bath, the temperature of which is known, and the position of the mercury noted. The temperature of the bath is raised, and the increase in temperature and volume read.

Boyle's Law.—The above apparatus is attached to a manometer by a T-tube, one limb of which is fitted with a stopcock. The volume of contained air and the atmospheric pressure are noted. Air is blown into the instrument through the stopcock, the drop of mercury is forced along the stem towards the bulb, and the mercury rises in the manometer. The stopcock is closed, and the volume of contained air and the difference in the height of mercury in the two limbs of the manometer read off and added to the atmospheric pressure.

Aqueous Vapour.—The apparatus and method employed has been described (*loc. cit.*). The same apparatus may be used to show the conjoint effects of heat, pressure, and aqueous vapour on a gas.

W. H. G.

Surface Tension of Dilute Aqueous Solutions. ADOLF HEYDWEILLER (*Ber. deut. physikal. Ges.*, 1908, **6**, 245—248).—The percentage alteration of the surface tension of solutions of chlorides of lithium, magnesium, ammonium, sodium, potassium, strontium, and barium produced by 1 gram-equivalent of the dissolved salt can be represented by an equation of the form $\Delta = Ai + B(1-i) + Cm$, in which A, B, and C are constants, and i is the degree of dissociation of the solute. A and B represent the influence exerted respectively by the ions and the undissociated electrolyte, and C is a measure of the internal cohesion pressure of the dissolved substance.

In the series of chlorides examined, A has a positive value, which with increasing equivalent weight first diminishes and then increases. B, which has a positive value for lithium and magnesium, becomes negative when the equivalent weight is further increased, and assumes gradually increasing negative values for the other chlorides from left to right.

From the values of C, numbers are calculated representing the constant a of van der Waals' equation as applied to solutions.

H. M. D.

Weight of a Falling Drop and Tate's Laws. Determination of the Molecular Weights and Critical Temperatures of Liquids by the Aid of Drop Weights. J. LIVINGSTON R. MORGAN and RESTON STEVENSON (*J. Amer. Chem. Soc.*, 1908, **30**, 360—376).—From the results of experiments on the weight of drops of water falling from a tube, Tate (*Phil. Mag.*, 1864, [iv], **27**, 176) deduced the following laws: (1) Other conditions being the same, the weight of a drop of liquid falling from a tube is proportional to the diameter of the tube in which it is formed. (2) The weight of the drop is proportional to the weight which would be raised in the same tube by capillarity. (3) Other conditions being equal, the weight of a drop of liquid is diminished by an increase of temperature. Tate used a thin-walled glass tube, the lower end of which was ground to a sharp edge, so that the part of the tube in contact with the drop might be regarded as infinitely thin.

The present investigation was undertaken with the object of testing these laws and of ascertaining if the temperature-coefficient of drop weight of any one liquid could be employed instead of the temperature-coefficient of surface tension in a formula similar to that of Ramsay and Shields as a means of determining molecular weights and critical temperatures.

An apparatus is described by means of which the volume (and hence the weight) of a single drop of a liquid falling from a tube can be accurately measured. Thick-walled capillary tubes were used, the ends of which were bevelled at an angle of 45°, and were found to have the same effect as those used by Tate in causing all liquids to drop from one and the same area. The liquids employed were ether, benzene, ethyl iodide, chlorobenzene, guaiacol, benzaldehyde, aniline, quinoline, and water.

The results show that for such tips as were employed, Tate's second and third laws are true, and that the first law is also true for bevelled tips of diameters between 4·68 and 7·12 mm. It is found that for the same liquid, falling drop weights can be substituted for the surface tensions in Ramsay and Shields' relation, and that molecular weights in the liquid state can be calculated with an accuracy equal to that obtained with surface tensions under the same, saturated air, conditions. Further, from a knowledge of the molecular weight of a non-associated liquid, the falling drop weight at one temperature, and the densities, it is possible to calculate the weight of a drop falling from the same tip at another temperature. Critical temperatures can be calculated by the aid of Ramsay and Shields' equation $\gamma(M/d)^{\frac{2}{3}} = k(\tau - 6)$, by substituting a drop weight for surface tension, and the molecular temperature-coefficient of drop weight for k, with the same precision as is attained by using surface tensions, against saturated air, provided that the drop weights from which the coefficient is found are determined at as many temperatures and at as high a temperature as the surface tensions.

A bibliography of the subject is appended. E. G.

Experimental Examination of Gibbs's Theory of Surface-concentration, Regarded as the Basis of Adsorption, with an Application to the Theory of Dyeing. W. C. M. Lewis (*Phil. Mag.*, 1908, [vi], **15**, 499—526).—Adsorption effects at liquid-liquid interfaces have been measured, and the results obtained are interpreted with reference to Gibbs's theory of surface-concentration in order to ascertain whether this theory affords an explanation of the general phenomenon of adsorption.

The adsorption measurements were made at the surface of separation of a hydrocarbon oil and an aqueous solution of bile salts ("sodium glycocholate"). The choice of these substances was determined by the fact that the hydrocarbon is chemically inert in respect of the solution, and that the solute lowers the interfacial tension between the water and the hydrocarbon.

By modifying Gibbs's fundamental expression, an equation has been obtained which gives the mass of solute adsorbed per square centimetre of surface in terms of the concentration of the solution and the alteration in the interfacial tension due to the dissolved substance. Determinations of the adsorption coefficient were made (1) at a very curved surface and (2) at an approximately plane surface, the corresponding interfacial tension measurements being carried out by the drop-pipette method. The values obtained in the two cases are in good agreement, which appears to point to the fact that the tension, even at very great curvatures, is not appreciably different from that at an approximately plane surface, but these experimental values are from twenty to eighty times greater than the values indicated by Gibbs's theory.

Experiments with dyes (Congo-red and methyl-orange) gave similar results, the discrepancy between theory and experiment being of the same order of magnitude.

An explanation of the observed differences has not yet been obtained.

H. M. D.

Determination of Viscosity at High Temperatures. CHARLES E. FAWSITT (*Proc. Roy. Soc.*, 1908, **80**, *A*, 290—298).—The method of determination is based on that described by Coulomb, in which the viscosity is calculated from the rate of decay of the amplitude of a horizontal circular disk which is allowed to execute vibrations about a vertical suspending wire. The disk used by the author was 26 mm. in diameter and 1 to 3 mm. thick. In order to make the disk heavy enough to sink in molten metals, a small, iron cylinder was clamped on to the vertical stem which forms the axis of rotation. The weight of the cylinder and its distance from the disk must be such as to keep the centre of gravity of the rigid part of the apparatus as low as possible. For temperatures up to 400°, iron may be used as material for the disk; for temperature up to a white heat, fire-clay or a mixture of fire-clay and plumbago is suitable. The apparatus was found to give good results for a number of liquids at the ordinary temperature, and measurements are recorded of the viscosity of mercury at temperatures up to 216°, and for sodium nitrate up to 450°. H. M. D.

Dissociation Pressures of Some Metallic Hydroxides and Carbonates. JOHN JOHNSTON (*Zeitsch. physikal. Chem.*, 1908, **62**, 330—358).—The dissociation pressures of calcium, strontium, barium, lithium, sodium and magnesium hydroxides, of lithium and sodium carbonates, and of the hydrates of barium and strontium hydroxides have been determined, mostly by a statical method, which is described in detail in the paper.

The results obtained for sodium hydroxide are very uncertain, but some of those for the other hydroxides are recorded in the following table. The figures represent the temperatures at which the hydroxide in question exerts the dissociation pressure given on the left.

p mm.	$Ca(OH)_2$.	$Sr(OH)_2$.	$Ba(OH)_2$.	LiOH.	$Mg(OH)_2$.
9·2	369°	452°	630°	561°	35°
31·5	408	524	710	628	53
92	448	597	789	700	74
234	488	670	870	782	100
526	527	742	951	875	147
760	547	778	998	924	—

The results obtained for the carbonates are similarly represented in the following table, in which are incorporated also the results obtained by other observers (Le Chatelier, *Compt. rend.*, 1886, **102**, 1243; Finkelstein, Abstr., 1906, ii, 354; Brill, Abstr., 1905, ii, 522). The values in brackets are extrapolated by means of the author's formulæ:

p mm.	$CaCO_3$.	$SrCO_3$.	$BaCO_3$.	Li_2CO_3.	$MgCO_3$.	Na_2CO_3.
5	[480°]	[814°]	1028°	740°	—	940°
10	[520]	[860]	1070	783	—	about 1100
50	616	[960]	1164	930	—	—
100	650	[1008]	1210	1010	—	—
760	825	1155	1350	[1270]	230°	—

The foregoing tables show that if the elements are arranged according to the readiness with which their compounds dissociate, the order is the same whether the hydroxides or the carbonates are considered, and the same also as that based on the periodic classification and on the physical properties (solubility, density, melting point, &c.) of the compounds. The author's experiments show also that the dissociating tendency of the hydrates of strontium hydroxide is much greater than that of the corresponding hydrates of barium hydroxide.

With the help of the equation $d(\log_e p)/dt = Q/RT^2$, the heats of dissociation of the hydroxides of calcium, strontium, barium, lithium, and magnesium are calculated from the author's observations. These calculated values are in good agreement with Thomsen's direct determinations. The values calculated from the author's observations by Nernst's formula (Abstr., 1906, ii, 727) are not in harmony with the experimental values.

A theoretical proof is given of Ramsay and Young's equation connecting the boiling points of different substances under any pressure the same for both. When this formula is applied to fatty alcohols or acids, to crystalline hydrates, or to the hydroxides of calcium, strontium, and barium, water being taken as the standard of comparison in each case, the curves obtained are straight lines. On the other hand, hydrocarbons, benzene derivatives, ethers and esters give a linear relationship when compared with fluorobenzene, but not when compared with water. J. C. P.

Osmotic Pressure. JOSEPH E. TREVOR (*J. Physical Chem.*, 1908, 12, 141—154).—A mathematical paper instigated by Porter's recent paper (Abstr., 1907, ii, 743) on the same subject. Porter's equation connecting osmotic pressure and vapour pressure is deduced by an alternative method, which shows the relation of the osmotic pressure to the reversible and irreversible work and heat of dilution.

Somewhat complicated expressions are given for the rate of change of the osmotic pressure with temperature at constant pressure and composition of the solution, and with the composition at constant pressure and temperature of the solution, and the assumptions made in van't Hoff's theory of solutions are discussed in the light of these results. The conditions for proportionality between osmotic pressure and the absolute temperature are zero heat of dilution and constant specific volume of the solvent. G. S.

Rôle of Imbibition in the Osmosis of Liquids. G. FLUSIN (*Ann. Chim. Phys.*, 1908, [viii], 13, 480—522. Compare Abstr., 1899, ii, 204; 1901, ii, 148, 439).—The author's experiments were made with the object of ascertaining whether there is, in general, a quantitative relation between the osmotic activity of a liquid towards a membrane and the amount of the liquid imbibed by the membrane.

The membranes employed were weighed in three different conditions: (1) dry before imbibition; (2) after imbibition, and (3) dry after imbibition. The last weight is always less than the first, and is used in the calculation of the coefficient of imbibition, which is defined as the volume in c.c. of liquid absorbed by 100 grams of the membrane at a definite temperature and in a certain time; the coefficient increases appreciably, but very slightly, with rise of temperature. The absorptive capacity of membranes, such as parchment paper or pig's bladder, varies for different membranes and diminishes markedly when the same sample is used more than once. The presence in the membranes of certain substances has a great influence on the extent of absorption.

The osmometer used was a modified form of that of Raoult (Abstr., 1895, ii, 487), and in place of the expression velocity of osmosis the author uses "osmotic debit" (débit osmotique), the apparent osmotic debit being the increase in volume (c.c.) of the liquid column in the measuring tube per hour per sq. dm. of membrane. For membranes from the same source, but of different thicknesses, the osmotic debit is inversely proportional to the thickness. The membranes employed consisted of vulcanised caoutchouc, parchment paper, pig's bladder, viscose, and copper ferrocyanide.

As regards their absorption by caoutchouc, organic liquids fall into two clearly-defined classes: (1) "active" liquids, or those which are absorbed energetically from the moment they come into contact with the membrane, and (2) "inactive" liquids, including water, with which an appreciable increase in weight of the membrane only occurs after several hours. The relative value of the coefficient of imbibition depends on the duration of imbibition. The osmotic debits are in the same order as, and roughly proportional to, the coefficients of imbibition, except for long durations of immersion. Apparent osmosis always takes place from the liquid with the higher towards that with the lower coefficient of imbibition.

With pig's bladder, the distinction between "active" and "inactive" liquids is less clearly marked than with caoutchouc. Water has the highest coefficient of imbibition, and next in order is acetic acid, which forms with the material of the bladder a moderately stable compound. In this case, too, the osmotic debits and the initial (five minutes) coefficients of imbibition vary in the same order, but the ratio has one value for the "active" and another for the "inactive" liquids.

With parchment paper or viscose, the only "active" liquid is water, the absorption of which is very rapid at first, but almost ceases after about ten minutes.

With solutions of various concentrations of sodium chloride, potassium carbonate, tartaric and acetic acids in contact with parchment paper, the osmotic debit varies as the diminution of the coefficient of imbibition, but bears no simple relation to the molecular weight of the solute even when ionisation is allowed for. Similar results were obtained with membranes of pig's bladder. With copper ferrocyanide membranes, the osmotic debits are inversely proportional to the molecular weights of the dissolved compounds if the concentrations of the solutions are the same in each case.

In order that osmosis may take place, it is not necessary for the two liquids to be miscible in all proportions.

A method is described of determining molecular weight by means of osmotic debits. T. H. P.

Kinetics of the Reaction between Chloric and Hydrochloric Acids. A Reaction of the Eighth Order. ROBERT LUTHER and F. H. MACDOUGALL (*Zeitsch. physikal. Chem.*, 1908, **62**, 199—242. Compare Abstr., 1906, ii, 436).—The method employed in studying this reaction was to pass a rapid current of an indifferent gas through the mixture, and so sweep away the chlorine and chlorine peroxide, the substances concerned in the intermediate equilibrium. By this procedure, these substances were kept permanently at a small concentration, and this permitted a quantitative study of the primary reaction. The necessary data for this study were obtained by absorbing the chlorine and chlorine peroxide in potassium iodide solution; the velocity of the reaction was thus ascertained as well as the ratio $ClO_2 : Cl_2$.

The velocity of the primary reaction is proportional to the fourth power of the $H^{\cdot}$ concentration, to the second power of the $ClO_3{}'$ concentration, and to the second power of the Cl' concentration, that is, the reaction as a whole is one of the eighth order. The net change may be represented by the equation:

$$4H^{\cdot} + 2ClO_3{}' + 2Cl' = 2ClO_2 + Cl_2 + 2H_2O,$$

but consideration of the experimental data shows that the separate stages are probably:

$$\text{Primary}: 4H^{\cdot} + 2ClO_3{}' + 2Cl' \rightleftharpoons 2H_2ClO_3 + Cl_2.$$

$$\text{Secondary}: \begin{cases} H_2ClO_3 \longrightarrow ClO_2 + H_2O \\ 4H^{\cdot} + 4Cl' + H_2ClO_3 \longrightarrow \tfrac{5}{2}Cl_2 + 3H_2O \end{cases}$$

Among the experimental facts which support the foregoing representation of the reaction are the following: the reaction is not noticeably retarded by chlorine peroxide; the ratio $ClO_2 : Cl_2$ in the products is practically independent of the intensity of the gas current, and the total reaction is retarded proportionally to the square root of the chlorine concentration.

In discussing the results from a general point of view, the authors point out that in oxidation-reduction reactions the primary product is probably always that compound which is in the next stage of oxidation. J. C. P.

Influence of Slow Dissociation on the Equilibrium between Phases. C. VAN ROSSEM (*Zeitsch. physikal. Chem.*, 1908, **62**, 257—283).—Ramsay and Young have found (*Phil. Trans.*, 1886, **177**, i, 82) that in certain cases the statical and dynamical methods of determining the vapour pressure of a solid lead to divergent and irregular results, the substances which exhibit this behaviour being all capable of dissociation, namely, aldehyde-ammonia, phthalic and succinic acids, and chloral hydrate and alcoholates. The author adopts Bancroft's explanation (Abstr., 1899, ii, 411) that, when a solid sublimes rapidly, there is not sufficient time for the establishment of the dissociation equilibrium. This interpretation is considered in detail in connexion with Ramsay and Young's experiments.

These investigators found also (*loc. cit.*) that, in the case of the chloral alcoholates, the vapour pressure of the supercooled liquid was smaller than that of the solid phase at the same temperature. Bancroft's explanation (*loc. cit.*) of this is rejected, and the author points out that the phenomenon was probably due to these alcoholates being contaminated with the alcohol from which they were crystallised.

Again, Ramsay and Young found (*loc. cit.*) that the statically-determined vapour pressure of succinic acid varied with the amount of the solid phase. Bancroft's explanation of this is rejected, and the author suggests that this phenomenon also is due to the slowness with which the dissociation equilibrium is reached. Increase of the quantity of the solid phase would involve increase of the subliming surface, and would therefore accelerate the establishment of the equilibrium. J. C. P.

Ammonia Equilibrium. F. Jost (*Zeitsch. anorg. Chem.*, 1908, **57**, 414—430. Compare Haber and van Oordt, Abstr., 1905, ii, 159, 384, 814; Haber and Le Rossignol, Abstr., 1907, ii, 454).—The equilibrium $N_2 + 3H_2 \rightleftarrows 2NH_3$ has been investigated between 685° and 1040° by means of the special electric furnace designed by Nernst (*Zeitsch. Elektrochem.*, 1907, **11**, 521), which admits of the investigation of gas reactions under high pressures. The furnace is described and figured. A mixture of hydrogen and nitrogen at partial pressures of 60 and 20 atmospheres respectively was passed slowly through the apparatus and the composition of the resulting mixture determined, and the equilibrium was also reached from the other side with a mixture containing excess of ammonia. Platinum, iron, and manganese were used as catalytic agents.

Between 700° and 1040°, the equilibrium is represented satisfactorily by the equation $\log x = 3065/T - 6{\cdot}918$, where x is the partial pressure of the ammonia. At 685°, 876°, and 1040°, the partial pressure of the ammonia is only 0·0178%, 0·0055%, and 0·0026% respectively. The heat equivalent of the reaction, calculated from the measurements by van't Hoff's equation, is 28,000 cal. at 1150°, compared with 24,400 cal. found by Berthelot at the ordinary temperature.

The results are in moderate agreement with those calculated by Nernst's formula connecting equilibrium and temperature, but the data are not sufficient to allow of a satisfactory comparison. The agreement between the author's results and those of Haber and Le Rossignol (*loc. cit.*) is also only moderate. G. S.

Equilibrium of Ammonia under Pressure. Fritz Haber and Robert Le Rossignol (*Zeitsch. Elektrochem.*, 1908, **14**, 181—196).—Nernst and Jost (*Zeitsch. Elektrochem.*, 1907, **13**, 521) have made determinations of the equilibrium condition of ammonia at temperatures between 685° and 1040°, and pressures of 12 to 70 atmospheres. The results do not agree with those obtained by the authors at atmospheric pressure (Abstr., 1907, ii, 454), and they have therefore made further experiments at 30 atmospheres pressure. The essential part of the apparatus used is a quartz tube containing iron or manganese asbestos; the tube (5 mm. internal diameter and 3 mm. thick) withstood the pressure of 30 atmospheres at 980°. Full details are given of the methods used to eliminate errors; the authors believe that the quantities of ammonia found are correct to within $2\frac{1}{2}\%$.

Equilibrium is attained from both sides. The final results are:

Temperature.	% NH_3 at 30 atmos. ($N_2 : H_2 = 1 : 3$).	$K \times 10^4$.
700°	0·654	6·80
801	0·344	3·56
901	0·207	2·13
974	0·144 to 0·152	1·48 to 1·56

The equilibrium constant K is defined by the ratio of the partial pressures of the gases $p(NH_3)/p(N_2)^{\frac{1}{2}} \times p(H_2)^{\frac{3}{2}}$. These numbers agree very well with the authors' previous experiments at atmospheric pressure; they do not agree with Nernst's theoretical calculations. The discrepancy is possibly due to an error in the heat of formation of ammonia or to an increase in the specific heat of ammonia at high temperatures. T. E.

Theory and Practice of the Iodometric Estimation of Arsenious Acid. Edward W. Washburn (*J. Amer. Chem. Soc.*, 1908, **30**, 31—46).—A study has been made of the equilibria involved in this analytical process, and the proper conditions to be observed at the end-point have been deduced from the results.

It is shown that the success of the titration depends on maintaining the hydrogen-ion concentration at a sufficiently small value. Calculation of the limits of the hydrogen-ion concentration gives 10^{-4} as the upper limit and 10^{-9} as the lower limit. If an accuracy of 0·001% is desired, the hydrogen-ion concentration must lie between these limits, the best value being their geometrical mean, which is almost identical with the concentration of the hydrogen ions in pure water. It follows, therefore, that at the conclusion of a titration of an arsenious acid solution with iodine the solution should be neutral.

A solution will maintain itself at any desired hydrogen concentration, even although small quantities of acid or base are added, if it contains something which will remove both hydrogen and hydroxyl ions. A solution containing the salt of a weak acid or base together with an excess of the acid or base has this property. It is shown that the ionisation constant of the acid should be numerically equal to the desired hydrogen-ion concentration. From theoretical considerations, it is found that phosphoric, carbonic, and boric acids are capable of meeting the requirements. In the case of phosphoric acid, it is shown that at the end of the titration the solution should contain about 2 mols. of Na_2HPO_4 to 1 mol. of NaH_2PO_4 in order that neutrality may be preserved. A 0·12 molar solution of sodium hydrogen carbonate, saturated with carbon dioxide, and a solution saturated with borax and boric acid are also capable of achieving the desired result. Experiments have proved that these conclusions are justified.

It is recommended that for accurate work the solutions should be weighed instead of measured, and a convenient form of weight-burette is described. Methods of preparing the standard solutions are given, and the mode of carrying out the titrations and the precautions to be observed are described.

The results of the investigation show that, under the proper conditions, iodine can be quantitatively reduced to iodide by arsenious acid, and that a definite, permanent, and exceedingly delicate end-point is obtained. E. G.

Mutual Solubility of Piperidines and Water. Otto Flaschner (*Zeitsch. physikal. Chem.*, 1908, **62**, 493—498).—Piperidine is miscible with water in all proportions between 0° and 250°, but some experiments in which potassium chloride was added to the mixed liquids indicate that the hypothetical lower critical solution-temperature (see Timmermans, Abstr., 1907, ii, 229) for the system piperidine + water is about 277°. The lower critical solution-temperature for methylpiperidine + water is 48·3°, the critical mixture containing 23% of the base. In this case, indications are obtained that the complete mutual solubility curve would be a closed one, but it is not fully realised. The lower critical solution-temperature for ethylpiperidine + water is 7·45°, the critical mixture containing 27% of the base. In the system *n*-propylpiperidine + water, the lower critical solution-temperature could not be reached, owing to the formation of solid; it appears to lie about $-20°$.

The author suggests a relationship between mutual solubility and dielectric constant. J. C. P.

Stability of Colloidal Solutions. II. The Svedberg (*Chem. Zentr.*, 1908, i, 88; from *Zeitsch. Chem. Ind. Kolloide*, 1907, **2**, 142—149. Compare Abstr., 1907, ii, 535).—By further studying the behaviour of slightly ionising solvents on colloidal solutions the author's view that the phenomena of coagulation are dependent on other factors than those considered by Billitzer (Abstr., 1907, ii, 535) is confirmed. If the activity of the ions is made as small as possible by using a medium having a small ionising effect and a colloidal substance with very small solubility pressure, such as platinum in ether, the following regularities are found. Concerning the temperature, there exist well-defined "critical points"(sharp coagulation points), and these are elevated on the addition of a small quantity of a non-colloidal substance. The "critical curves," which show the relation between the temperature of coagulation and the amount of added material, are asymptotic to the negative temperature axis. An increase of solubility pressure of the colloid, or an increase of the ionising power of the solvent, causes in each case a decrease in the sharpness of the "critical point." J. V. E.

Process of Formation of Hydrosol and Hydrogel. II. Adsorption of Silver Nitrate and Potassium Iodide by Amorphous Silver Iodide. Alfred Lottermoser and A. Rothe (*Zeitsch. physikal. Chem.*, 1908, **62**, 359—383. Compare Abstr., 1907, ii, 851; also Abstr., 1905, ii, 586; 1906, ii, 429; 1907, ii, 78).—Pure silver iodide was prepared by precipitating ammoniacal potassium iodide with ammoniacal silver nitrate, the product being successively washed with ammonia, water, nitric acid, and water again. When such amorphous silver iodide is shaken with a solution of silver nitrate, some of the latter substance is adsorbed, and the adsorption is in harmony with the usual formula $x/m = \beta.c^{1/p}$. The equilibrium is established very rapidly when a series of silver nitrate solutions of gradually increasing concentration is used, but very slowly when the concentration is changed in the opposite direction. It is therefore practically impossible to free silver iodide completely from adsorbed silver nitrate by mere washing with water.

When a solution containing $Ag^{\cdot}$ ions is added to a solution containing I' ions, so that the latter are always in excess, a negative hydrosol is formed, provided the concentration is below a certain maximum value. Similarly, when a solution containing I' ions is added to one containing $Ag^{\cdot}$ ions, so that the latter are always in excess, a positive hydrosol is formed, provided the concentration is less than a certain maximum value. This maximum concentration, at which formation of hydrosol can take place, is much lower in the latter case than in the former. The maximum concentration is markedly lowered by multivalent cations where a negative hydrosol is being formed, and by multivalent anions where a positive hydrosol is being formed. Multivalent cations are without influence on a positive hydrosol, and multivalent anions have no effect on a negative hydrosol.

Moist amorphous silver iodide can be converted into a hydrosol by I' ions. This effect reaches a maximum for a certain concentration of the iodide; the higher the valency of the metal in the iodide the lower is the concentration which gives the maximum effect. The structure of amorphous silver iodide is altered by I' ions, and this is probably the reason why the adsorption of potassium iodide by moist amorphous silver iodide does not take place in accordance with the usual adsorption law. J. C. P.

[Action of Some Electrolytes on Colloidal Silver Solutions. The Process of Coagulation.] ALFRED LOTTERMOSER (*Zeitsch. physikal. Chem.*, 1908, **62**, 284—286).—A criticism of Woudstra's recent paper (this vol., ii, 160). J. C. P.

Mutual Flocculation of Colloids. OSCAR TEAGUE and BERNARD H. BUXTON (*Zeitsch. physikal. Chem.*, 1908, **62**, 287—307).—The rule that the degree of flocculation and the extent of the region of optimal concentration (Abstr., 1907, ii, 933) depend on the degree in which the substances are colloidal (rule of colloidal flocculation) was first observed to hold for aniline dyes, and is now found to apply to a number of other colloids. The mutual flocculation of an acid and a basic dye is greatest when the two are mixed in equivalent proportions. An inorganic salt (sodium chloride) is formed by double decomposition, and extends the flocculation zone. Histological experiments indicate that highly colloidal dyes are more firmly united than the less definitely colloidal ones. G. B.

Parallel Growths of Crystals and Isomorphous Miscibility. THOMAS VIPOND BARKER (*Min. Mag.*, 1908, **15**, 42—53).—The experiments on the parallel growth of soluble salts on each other (Abstr., 1907, ii, 240) are continued with the sulphates and chromates of the alkali metals. Although isomorphous miscibility and the formation of parallel growths of crystals are favoured by the same factor, namely, similarity in molecular volume and crystal-structure, yet these two properties do not always go hand in hand, for many immiscible or only slightly miscible substances readily form parallel growths. Mixed crystals cannot therefore be regarded as being built up of alternating parallel layers. The bearing of parallel growths on questions of isomorphism and the limitations of the term isomorphism are discussed.

L. J. S.

Isomorphism. B. GOSSNER (*Zeitsch. Kryst. Min.*, 1908, **44**, 417—518).—A lengthy dissertation on isomorphism in general.

L. J. S.

Supposed Alteration in the Total Weight of Substances taking part in a Chemical Reaction. HANS LANDOLT (*Sitzungsber. K. Akad. Berlin*, 1908, 354—387. Compare Abstr., 1906, ii, 528).—The author gives the final results of his extensive investigations on the question whether changes in total weight take place when substances undergo chemical change. The fact that in the majority of the changes previously investigated a small loss of weight was found has led the author to examine whether this might not be due to the circumstance that these changes take place with development of heat, resulting in a diminution of the amount of water condensed on the surface of the glass vessels and also in an increase of volume of the apparatus. The recovery from these disturbances was examined by determining the weights of the reaction vessels from day to day over much longer intervals of time than those during which observations were made in the earlier experiments. As a result of these new measurements, the supposed preponderance of the reactions which take place with loss of weight disappears, and in nearly all of the forty-eight experiments the changes in weight fall within the estimated limits of experimental error. The final conclusion drawn by the author is that in none of the fifteen different chemical changes which have been examined can a change in the total weight of the reacting substances be recognised.

H. M. D.

Deduction of the Stoicheiometric Laws. O. DE VRIES (*Zeitsch. physikal. Chem.*, 1908, **62**, 308—329).—The author criticises at length the attempt made by Wald (Abstr., 1897, ii, 311, 400; 1898, ii, 64, 159, 327; 1899, ii, 276; 1907, ii, 755) to provide an *a priori* foundation for the stoicheiometric laws, as well as the similar attempts made by Ostwald (Trans., 1904, **85**, 506), Benedicks (Abstr., 1906, ii, 530), and Baur (Abstr., 1906, ii, 661). It is considered that the proofs given by these writers are either faulty in themselves or are based on facts which are equivalent to those involved in the stoicheiometric laws. These laws should be regarded as purely experimental in character. [For other papers bearing on this subject, see Nasini, Abstr., 1905, ii, 514; Kuhn, Abstr., 1907, ii, 678; this vol., ii, 98.] J. C. P.

Are the Stoicheiometrical Laws Intelligible without the Atomic Hypothesis? F. WALD (*Chem. Zeit.*, 1908, **32**, 299—301. Compare Abstr., 1907, ii, 678, 755).—Polemical. A further reply to Kuhn. P. H.

Choice of the Most Probable Value for an Atomic Weight: Atomic Weight of Hydrogen. WILLIAM A. NOYES (*J. Amer. Chem. Soc.*, 1908, **30**, 4—8).—The following suggestions are made as a guide to the selection of the most probable value for an atomic weight. (1) When an observer discovers sources of error in the work of an earlier observer and succeeds in avoiding them in his own work, the later work should be accepted and the earlier work regarded as of only confirmatory value. (2) When the results obtained by two independent observers agree, whilst those of a third are discordant, much greater weight should be given to the former than to the latter; and, further, values obtained by one author which differ markedly from those obtained by several authors should be rejected. (3) After eliminating certain results by (1) and (2), the remainder should be arranged in the order of their probable errors. Any result with a probable error more than five times that of the smallest probable error should be excluded, and the values remaining for a given ratio should be combined by weighting them inversely as the squares of their probable errors. The ratios thus selected should be weighted, not by the mathematical probable error, but by the deviation of the results of different observers from the value selected. The combination of the experimental ratios for the calculation of atomic weights should be carried out by the application of the same general principles.

On applying these principles to the determinations which have been recorded of the atomic weight of hydrogen, the value 1·00775 is obtained ($O=16$) (compare this vol., ii, 100). E. G.

Number of Corpuscles in the Atom. J. BOSLER (*Compt. rend.*, 1908, **146**, 686—687).—The total potential energy of 1 gram of hydrogen is $\frac{N(ne)^2}{a}=n^2 10^{13}$ ergs, where N is the number of atoms (about 10^{24}) in 1 gram, n the number of electrons in the atom, e their charge (about $3{\cdot}2\times10^{-10}$), and a the radius of the atom (10^{-8}); the corresponding value in the case of radium is $(225/3)\times n^2 10^{13}$ or $n^2 10^{15}$ ergs, whilst the observed value calculated from Curie's measurement of the heat emanation, and Rutherford's estimate of the life of radium, is 3×10^{16} ergs; it follows therefore that the number, n, of corpuscles in the atom of hydrogen is of the order of units, and this result is in agreement with the results of J. J. Thomson's later experiments, from which he concluded that the number of corpuscles of the atom is of the order of greatness of the atomic weight.

M. A. W.

Chemical Elements. Periodicity, Weight, and Valency. George Woodiwiss (*Chem. News*, 1908, **97**, 122—124).—An attempt to find relationships between the specific gravities of the elements in the solid state and their atomic weights. It is assumed that the valency of the elements in the long series of Mendeléeff's table increases uniformly from the first to the eighth group, the elements in which have a valency of eight, and then decreases uniformly. The elements of the copper and zinc groups are thus septa- and sexa-valent respectively. When the specific gravities of the elements are divided by these hypothetical valencies, numbers are obtained which, in the case of the metals, increase uniformly with the atomic weights, and when plotted on a diagram with atomic weight as abscissa these numbers fall approximately on a straight line. The numbers for the non-metallic elements do not correspond at all with this relationship.

H. M. D.

Theory of Valency and Constitution of Salts. Grégoire N. Wyrouboff (*Ann. Chim. Phys.*, 1908, [viii], **13**, 523—561).—The author advances a new theory of the formation and constitution of salts which comprehends the so-called molecular compounds as well as the ordinary atomic compounds. He also applies the notion of mixed functions, generally used only in connexion with organic compounds, to inorganic substances. The ideas involved in the terms partial valency, crypto-valency, pseudo-valency, and secondary valency are criticised.

All theories of valency confound the chemical energy inherent in an atom with its valency, or, in other words, the sum of the chemical actions which it can exert according to the laws of definite and multiple proportions with the number of atoms of a certain kind with which it can combine directly. By separating these two notions, the problem of valency becomes greatly simplified, as also does that of molecular compounds. The valency of a molecule is regarded as being independent of the atomicity of the atom from which it originates, and the combination of a molecule $M(OH)_n$ with nHCl is represented, not by the equation $M(OH)_n + nHCl = MCl_n + nH_2O$, but by $M(OH)_n + nHCl = M(OH)_n,nHCl$. So that salts are produced by the neutralisation of two different functions without elimination of water, and are characterised by being electrolytes and by being capable of taking part in double decompositions. The following considerations are brought forward in support of this hypothesis. A large number of hydrated salts are known from which it is impossible to remove all the water without decomposing them, or, at any rate, completely changing their character. This is the case, for example, with magnesium sulphate and chloride and with the chlorides of the alkaline-earth metals, and the stable hydrates generally represented as $MgSO_4,H_2O$ and $MCl_2,2H_2O$ are regarded as containing water of constitution $M(OH)_2,H_2SO_4$ and $M(OH)_2,2HCl$. Thermochemical data are quoted to show that the water in such stable hydrates is present in a form different from that in which any further water absorbed exists. Thus 1 mol. of calcium sulphate, in taking up $2H_2O$ to form gypsum, $Ca(OH)_2H_2SO_4$, evolves 4·4 Cals., whilst 1 mol. of gypsum dissolves in water with absorption of 0·3 Cal. When dehydrated compounds dissolve in water, they are regarded as combining with water and passing from the condition of anhydrides to that of true salts. Salts which are always anhydrous in the solid state are looked on as resulting from the instability of the hydrated salts in the solid form. The formation of organic salts without elimination of water is cited in support of the above theory of salt formation.

The author also discusses the compounds $Pt(OH)_2Cl_2,2HCl,2H_2O$ and $PtCl_4,2HCl,2H_2O$, which he regards as derived from the non-existent or unstable normal salt $Pt(OH)_4,4HCl$; the compound $Cr_2(C_2O_3)_3(OH)_6$; the compound $Cr_2(OH)_6$, which presents itself under four distinct aspects: with exclusively (1) basic or (2) alcoholic functions; (3) with functions partly acid and partly basic, as in the green chromium compounds, and (4) in a form in which the hydroxyls are acid and alcoholic at the same time.

Colson's work (this vol., ii, 45) is criticised. T. H. P.

Apparatus for the Centrifugal Draining of Small Quantities of Crystals. Gregory P. Baxter (*J. Amer. Chem. Soc.*, 1908, **30**, 286—288. Compare Richards, Abstr., 1905, ii, 238).—The apparatus consists of an aluminium cup containing a platinum crucible and fitted with a rubber sleeve, which in turn holds a platinum Gooch crucible. The aluminium cup is attached by means of trunnions to the centrifugal machine. The crystals are placed in the Gooch crucible, and the mother liquor drains into the platinum crucible beneath. The removal of the platinum crucible is facilitated by a hole situated at the bottom of the aluminium cup. A full description and diagram of the apparatus are given. E. G.

Inorganic Chemistry.

Origin of the Green Colours of Natural Waters. Walthère Spring (*Arch. sci. phys. nat.*, 1908, [iv], **25**, 217—227).—The green colours of natural waters are attributable in some cases to the presence of colouring matters, and in others to the presence of very finely-divided suspensions, which give rise to diffraction phenomena; the colour effects due to these causes result in a modification of the blue colour of pure water.

The colours of water containing finely-divided suspensions of various kind have been examined in columns 6 metres long. A suspension of silica, obtained by heating precipitated silicic acid and removing the larger particles by levigation, exhibits the blue colour of pure water. A suspension of mastic, obtained by mixing an alcoholic solution with water, is dark brown in colour; on diluting with pure water, the colour changes to a greenish-blue. Colloidal solutions of aluminium hydroxide and silicic acid prepared by dialysis exhibit a deep reddish-brown colour. On diluting these suspensions with gradually increasing quantities of pure water, the colours exhibited are in succession yellow, yellowish-green, green, greenish-blue, and blue. These experiments show that the green colours of many natural waters can be attributed to diffraction phenomena, due to the presence of finely-divided substances in suspension. H. M. D.

Formation of Hydrogen Peroxide. Franz Fischer and O. Ringe (*Ber.*, 1908, **41**, 945—954).—The formation of hydrogen peroxide, which as an endothermic compound should be produced from steam and oxygen at high temperatures under suitable conditions, has been observed by several investigators either by the explosion of oxyhydrogen gas with an excess of oxygen or by the sudden cooling of the gases issuing from a flame of burning hydrogen; Nernst, however, has proved that the process of combustion itself, as such, is not responsible for the formation of hydrogen peroxide, since the latter is produced when water is sprayed on to a glowing Nernst filament.

The authors have now approached the subject with the experience gained in the experiments on the formation of ozone at high temperatures (compare Fischer and Brähmer, Abstr., 1906, ii, 224; Fischer and Marx, Abstr., 1906, ii, 606, 627, 845; 1907, ii, 163, 340), with the following results. (1) Nernst's experiments with a glowing filament are confirmed. (2) A tube of magnesia, 8—10 cm. long and 0·6 mm. wide, is attached to a capacious tin condenser. The middle of the tube is heated by a bunsen burner, and the end, as near as possible to the condenser, raised to a white heat. When steam under a pressure of 40 mm. of mercury is passed through the tube, the condensed liquid contains 0·0045% of hydrogen peroxide. With magnesia tubes, 0·3 mm. or 1·0 mm. wide, only traces of hydrogen peroxide are obtained. (3) Steam, issuing from a sloping quartz capillary tube, was directed, at a distance of 4—6 mm., on to a flame of hydrogen, 4—6 cm. in height, which was thus blown into the neck of a tin condenser. When the pressure driving the steam was 7 mm. of mercury, 0·067% of hydrogen peroxide was found in the condensed liquid, although the condensation was incomplete in consequence of the velocity of the gaseous stream. (4) Contrary to Nernst's observations (Abstr., 1906, ii, 17), the authors find that hydrogen peroxide is formed when a current of steam and oxygen is submitted to a spark discharge, provided that the velocity of the current is sufficiently great to allow of a rapid cooling of the escaping gases. (5) Traces of hydrogen peroxide are formed when steam is submitted to the silent electric discharge, the temperature being 130°, to prevent condensation of water within the ozoniser. Better results are obtained with a mixture of steam and oxygen or steam and air.

C. S.

Catalytic Decomposition of Hydrogen Peroxide under High Pressures of Oxygen. E. B. Spear (*J. Amer. Chem. Soc.*, 1908, **30**, 195—209).—It has been suggested by several authors that in the catalytic decomposition of hydrogen peroxide an important part is played by the dissolved or chemically bound oxygen. In order to study this point, an investigation has been carried out with the object of ascertaining the effect produced on the decomposition by increasing the concentration of oxygen. For this purpose, a method has been devised for determining rates of reaction under high pressures. The apparatus employed and the manner of conducting the experiments are described in detail.

The results show that the catalytic decomposition of hydrogen peroxide by colloidal solutions of platinum, palladium, iridium, gold, and silver is not appreciably affected by increasing the pressure of oxygen above the reaction mixture from 1 to 200 atmospheres.

E. G.

Atomic Weight of Chlorine. William A. Noyes and H. C. P. Weber (*J. Amer. Chem. Soc.*, 1908, **30**, 13—29).—The only determination of the atomic weight of chlorine made by direct comparison of hydrogen and chlorine is that of Dixon and Edgar (Abstr., 1905, ii, 696).

Determinations have now been made by the direct union of hydrogen and chlorine, the hydrogen being weighed absorbed in palladium, and the chlorine in the form of potassium platinichloride. The hydrogen was passed over the heated potassium salt, and the hydrogen chloride was collected and weighed. Two independent series of ratios were thus obtained.

An account is given of the methods by which the materials were purified and weighed, as well as a description of the way in which the determinations were carried out.

In the first series, consisting of seven experiments, the hydrogen chloride was absorbed directly by water, whilst in the second series the hydrogen chloride was first condensed to a solid with liquid air, and was absorbed by water after connexion with the other parts of the apparatus had been cut off, the object being to avoid the risk of transference of water from the absorption apparatus to the potassium platinichloride tube. The results of the two series agree very closely, and give $Cl = 35·452$ ($H = 1·00762$) or $35·461$ ($H = 1·00787$). The values for silver, calculated from Richards and Wells' results (Abstr., 1905, ii, 450) and these two values, are 107·87 and 107·89 respectively. The mean values are considered the most probable, namely, $Cl = 35·457$ and $Ag = 107·88$.

E. G.

Changes in the Properties of Chlorine. Josef von Ferentzy (*Chem. Zeit.*, 1908, **32**, 285—286).—The statements made by Fabinyi and Förster (compare Abstr., 1906, ii, 435) are erroneous, and their experimental results may be explained by the fact that they did not sufficiently purify their chlorine and carried out the preparation in sunlight. Chlorine prepared by the usual methods always contains oxygen compounds, but the amount is particularly large when the chlorine is prepared by adding sodium chloride to a mixture of potassium dichromate and sulphuric acid. Hypochlorous acid has a marked effect in promoting the conversion of the chlorine in chlorine water into hydrogen chloride.

P. H.

Influence of Ozone on the Condensation of Water Vapour. G. Leithäuser and R. Pohl (*Ber. deut. physikal. Ges.*, 1908, **6**, 249—255).—The question whether ozone facilitates the condensation of water vapour has been examined. When increasing quantities of nitrogen are mixed with ozone, the condensation takes place more and more readily. This is attributed to the formation of oxides of nitrogen, and it is shown that condensation does not occur when these are removed by passing the ozonised gas through a tube cooled to − 79°. Two kinds of cloud formation are described. A nearly colourless cloud consisting of large drops is caused by nitrogen pentoxide, whilst a blue cloud of very small drops is caused by some other oxide of nitrogen, which is formed by the action of ozone on nitrogen pentoxide.

The condensation of water vapour is also facilitated by ozone when traces of other substances, such as chlorine and iodine, are exposed to its action, with the result that acid anhydrides are formed as in the case of nitrogen. H. M. D.

The Gases Sulphur Dioxide, Dimethyl Ether, and Methyl Chloride. G. Baume (*J. Chim. Phys.*, 1908, **6**, 1—91).—A detailed account is given of measurements of the density and the compressibility at low pressures of sulphur dioxide, dimethyl ether, and methyl chloride. The critical pressure and temperature of methyl chloride have also been determined.

The weights of a litre of sulphur dioxide, methyl ether, and methyl chloride at 0° and 760 mm. are respectively 2·9266, 2·1096, and 2·3045 grams; the coefficients, representing the deviations from Boyle's law between pressures of 0 and 1 atmosphere, are for the three gases, 0·02380, 0·02656, and 0·02215; the critical temperature and pressure of methyl chloride are respectively 416·3° (absolute) and 65·85 atmospheres.

These numbers are used for the determination of the molecular weights of the three gases according to the methods which have been indicated by Leduc, D. Berthelot, and Guye.

When the densities of the gases are calculated by the method of molecular volumes, values are obtained which agree with the experimental values within 0·1% to 0·3%. The method of limiting densities and the method based on the reduction of the critical data give values slightly smaller than the experimental values, the agreement being closer when the density method is employed. H. M. D.

"Tellurium." Is it a Mixture of Two Elements? William Bettel (*Chem. News*, 1908, **97**, 169—170).—Some twenty-five years ago, the author's attention was drawn to a silver "telluride" ore which exhibited anomalous behaviour on cupellation. The beads of silver instead of solidifying to buttons spread out in irregular films, which in some cases were over an inch in diameter, leaving a protuberance in the centre of the cupel. In the case of another ore examined four years later, a film of only 2 mm. width was formed around the silver bead, a similar result being obtained on cupelling ordinary silver lead to which pure tellurium of commerce had been added. Suspecting that the original ore contained a new element, and having exhausted his supply, the author appeals to others for samples of silver "telluride" ores the behaviour of which is in any way peculiar. P. H.

Oxidation of Hydrazine. II. Arthur W. Browne and F. F. Shetterly (*J. Amer. Chem. Soc.*, 1908, **30**, 53—63).—In an earlier paper (Abstr., 1907, ii, 863), it was shown that hydrazine sulphate is oxidised by ammonium metavanadate with formation of azoimide.

An account is now given of the action of potassium chlorate, bromate, and iodate, and of the halogens on an acid solution of hydrazine sulphate. The experiments were carried out with the object of ascertaining whether azoimide is produced in these reactions, and of determining the yield under particular conditions. The following results were obtained.

When a solution of hydrazine sulphate is treated with potassium chlorate or bromate in presence of sulphuric acid, the hydrazine is not completely oxidised to nitrogen and water, but a secondary reaction takes place: $2N_2H_4 + 2O = N_3H + NH_3 + 2H_2O$. In the case of potassium chlorate, the highest yields obtained were 22·44% of azoimide and 48·76% of ammonia, whilst with potassium bromate 6·68% of azoimide and 9·77% of ammonia were formed. With potassium iodate, neither azoimide nor ammonia was produced. The amount of azoimide formed decreases therefore with increase in the atomic weight of the halogen.

When hydrazine sulphate is treated with chlorine, a small quantity of azoimide is produced in both acid and alkaline solutions, whilst, with bromine, traces are formed in an alkaline solution and none in an acid solution, and, with iodine, none is produced either in acid or alkaline solution. Hence the slight tendency of halogens to produce azoimide decreases with increase in the atomic weight of the element.

By the oxidation of hydrazine sulphate in presence of sulphuric acid and silver sulphate, the following maximum yields of azoimide and ammonia were obtained. With potassium chlorate, 13·32% N_3H, 16·96% NH_3; with potassium bromate, 11·65% N_3H, 27·42% NH_3; with potassium iodate, 11·16% N_3H, 16·16% NH_3. The influence of silver sulphate in increasing the yield of azoimide varies directly therefore with the atomic weight of the halogen. E. G.

The Phosphorus-Arsenic Group. Gottlob E. Linck (*Ber.*, 1908, **41**, 822—823. Compare Abstr., 1899, ii, 415; this vol., ii, 176).—Polemical. A reply to Stock (this vol., ii, 176) and Erdmann (this vol., ii, 275). W. H. G.

Glowing of Phosphorus and Some of its Compounds. Ernst Scharff (*Zeitsch. physikal. Chem.*, 1908, **62**, 179—193).—The phosphorescence phenomena exhibited by phosphorous oxide have been studied, and are found to resemble those observed with phosphorus itself. In perfectly dry oxygen, phosphorous oxide is not luminous at any pressure between 100 and 800 mm., or at any temperature between 19° and 60°. When the oxygen is moist, phosphorescence is exhibited so soon as the pressure falls below a certain limiting value. At first, it is intermittent, but, as the pressure is still further reduced, the glow becomes steady and permanent. On reversing and raising the pressure, the steady glow passes gradually into an intermittent phosphorescence, which ceases when the limiting pressure has been reached. The value of the limiting pressure increases with rising temperature, and at the ordinary temperature is about 350 mm.

The change from intermittent to permanent phosphorescence, or vice versâ, is well shown by phosphorus sesquisulphide, for which there exists a limiting pressure in dry oxygen. In this case, no phosphorescence is exhibited until a temperature of 65° is reached, whilst at 90° the substance is burned up. It takes fire also when the permanent phosphorescence is allowed to become fully developed at temperatures below 90°. The combustion occurs in a pulsatory fashion ("stossweise") with a greenish light, in a similar manner to the trioxide. The phosphorescence disappears generally at a higher pressure than that at which it first appeared, the difference between the two pressures increasing with rising temperature. This behaviour is attributed to the heat effect of the reaction, in virtue of which the temperature is raised and the limiting pressure is accordingly higher. In moist oxygen, the limiting pressures for phosphorus sesquisulphide are higher than in dry oxygen.

The luminosity exhibited by phosphorus itself was studied under conditions similar to those employed in the previous experiments, the ozone produced in this case being removed by Para rubber. It is found that the various phases of the phenomenon are very similar to those observed with the oxide and sulphide, and it is therefore probable that for the phosphorescence of phosphorus the trioxide is mainly responsible. The usual vigour of the phosphorus oxidation is to be attributed to the presence of ozone; the limiting pressure in the case of phosphorus, that is, the pressure above which no phosphorescence is exhibited, is very nearly a linear function of the temperature, as found by Joubert.

The vapours of organic substances tend to prevent the phosphorescence of phosphorous oxide and phosphorus sesquisulphide. The author's observations in this direction agree generally with those made by Centnerszwer on the effect of these vapours on the luminosity of phosphorus (see Abstr., 1898, ii, 427). J. C. P.

Reversion of Phosphoric Acid in Superphosphates. KARL HERBST (*Chem. Zentr.*, 1908, i, 285; from *Oesterr.-ung. Zeitsch. Zuckerind. Landw.*, 1907, **36**, 645—652).—Neither calcium nor magnesium salts cause the soluble phosphate in superphosphate to change back to the insoluble, but ferrous and ferric sulphates, formed from the natural phosphate by using sulphuric acid in the preparation of the superphosphate, bring about this change. The monocalcium phosphate in the presence of ferrous and ferric sulphates changes into the insoluble ferric phosphate, $FePO_4,xH_2O$. In the case of monoaluminium phosphate, $AlH_6(PO_4)_3$, a similar change takes place in the presence of ferric sulphate, sulphuric acid being liberated and ferric aluminium phosphate, $Al_2O_3,Fe_2O_3,(P_2O_5)_2,H_2O$, produced. The author suggests that to increase the value of the superphosphate the iron salts should be rendered indifferent or extracted. J. V. E.

Colloidal Graphite. E. G. ACHESON (*Chem. Zentr.*, 1908, i, 210—211; from *J. Franklin Inst.*, 1907, **164**, 375—382).—The addition of tannic acid solution to clay has been shown to render it more plastic and incapable of filtration. The author treats graphite in a similar manner, with the object of obtaining it in a more suitable form for lubrication. The best results were arrived at by stirring graphite for a long time with 3—6% of its weight of tannin in aqueous solution. Colloidal graphite obtained in this manner remains for weeks and months in suspension, and passes through all filters; the addition of hydrochloric acid causes it to separate in a flocculent state.

J. V. E.

Cuprous Compounds of Carbon Monoxide. WILHELM MANCHOT and J. NEWTON FRIEND (*Annalen*, 1908, **359**, 100—128. Compare Manchot and Zechentmayer, Abstr., 1907, ii, 93; Jones, Abstr., 1900, ii, 17; Berthelot, Abstr., 1901, i, 493).—The characteristic property of forming additive compounds with gases, such as oxygen, carbon monoxide, and nitric oxide, possessed by hæmoglobin as a metallic complex, makes it desirable to investigate the dissociating additive compounds of metallic salts with those gases. Such studies, moreover, may be expected to throw light on the primary action of free oxygen on the unsaturated metallic compounds. Hence the authors have studied quantitatively the absorption of carbon monoxide by cuprous chloride under varying conditions, and have obtained the following results.

The absorption of carbon monoxide by cuprous chloride in hydrochloric acid solution increases with decreasing concentration of the hydrogen chloride, with lowering of the temperature, with increasing concentration of the cuprous chloride, and with increasing pressure of the carbon monoxide. Similar results are obtained with sulphuric acid solutions. The absorption by means of cuprous chloride and water takes place very slowly, and diminishes as the amount of water increases. The results are not markedly affected by the employment of saturated ammonium sulphate solutions in place of water. Cuprous hydroxide does not combine with carbon monoxide, but in presence of sodium hydroxide it is slowly reduced to copper, small amounts of carbonate being formed.

In all the cases studied, there is formed the compound

$$CuCl,CO,2H_2O,$$

which crystallises in colourless leaflets, decomposes, evolving carbon monoxide on exposure to air, is decomposed by alcohol, concentrated sulphuric acid, or sodium hydroxide, and forms a brownish-black solution in hydrochloric acid. The ratio Cu : CO determines the maximum limit of absorption, which is approached under optimum conditions as to temperature, carbon monoxide pressure, concentration of cuprous chloride, and nature of the solvent, but is never exceeded. This agrees with Jones's observation (*loc. cit.*) that the absorption may be much greater than that corresponding with Berthelot's formula $CO(CuCl)_2$.

Similar results are obtained with cuprous chloride, bromide, or iodide in dilute ammoniacal solution, and with cuprous chloride dissolved in aniline, *o*-toluidine, or piperidine. In each case, the limit of absorption is in the ratio Cu : CO, which in the organic solvent is attained to under the ordinary pressure. In concentrated ammonia, the absorption diminishes with increasing copper concentration.

The addition of carbon monoxide to cuprous chloride takes place only simultaneously with the addition of water, or of some substance, such as ammonia or aniline, which can act as a substitute for wâter. Thus cuprous chloride does not absorb carbon monoxide in alcoholic solution. This explains the occurrence of many reactions, such as the combustion of carbon monoxide, only in presence of moisture. Where such a reaction takes place in two stages, the second leading to the re-formation of the water, this acts as a catalyst. G. Y.

Combustion of Gases by Incandescence in the Presence of Oxidisable and of Non-combustible Substances. Jean Meunier (*Compt. rend.*, 1908, **146**, 757—758).—The curious behaviour of incandescent bodies in the presence of explosive gases and the mechanism of flameless combustion (this vol., ii, 11, 276) are to be explained by the localisation of the combustion on the incandescent surface. The results with an oxidisable incandescent substance are different from those when this is incombustible. When a spiral of pianoforte wire, 1 metre long and weighing 0·33 gram, is heated to redness by an electric current in a closed vessel containing 100 c.c. of a mixture of 9·2% of methane, 18·5% of oxygen, and 72·3% of nitrogen, the spiral oxidises, increasing 0·0115 gram (corresponding to 8·5 c.c. of oxygen) in weight, whilst the residual gas contains 10 c.c. of oxygen, but no carbon dioxide, showing that none of the methane is burnt. As the spiral only occupies 40 cubic millimetres, that is, 1/2500th of the volume of the gas, the oxygen cannot be supplied to it by connexion currents alone, but must actually be attracted by the incandescent metal. A lead wire exhibits the same phenomenon. The metals generally do not remain incandescent when heated and then placed in an inflammable gaseous mixture, although platinum and nickel (the disk in the experiment previously described, *loc. cit.*, was of nickel, not copper as there stated) have this property. Certain oxides, however, possess the property to a high degree. Thus, if the ashy skeleton of a half-burnt match is placed 4 mm. from the flame of a candle, it becomes incandescent, and at a distance of 1—2 mm. the incandescence is very vivid.

The intensity of the incandescence depends, not only on the nature of the incandescent substance, but also on the composition of the surrounding gas. E. H.

Low Ignition Temperature of Carbon Disulphide. F. Scriba (*Chem. Zentr.*, 1908, i, 100; from *Zeitsch. phys.-chem. Unters.*, 1907, **20**, 390).—If a pellet of cotton-wool soaked in carbon disulphide is placed in a funnel, the stem of which is closed at the end, and allowed to remain, the vapour may be ignited by sparks from flint and steel on opening the funnel stem. Besides showing the high density of the vapour, this explains its occasional ignition upon treading the earth round the vines when destroying grape phylloxera. J. V. E.

Silicon as a Reducing Agent for the Oxides of Refractory Metals. Bernhard Neumann (*Zeitsch. Elektrochem.*, 1908, **14**, 169—172).—Silicon and metallic oxides do not react by the application of a fuse, and the author therefore brings about reaction by adding the mixture to a fused bath of alumina (150 parts) and lime (100 parts) in an electric arc furnace. The temperature of the fused bath is about 1600°, and this is raised by the reaction. A ferro-silicon with 91·65% silicon and 1·03% carbon is used. Chrome-iron ore yielded a ferro-chromium containing 35% to 43% chromium, 2·5% to 3·7% silicon, and 0·8% to 1·5% carbon. Pure chromium oxide yielded a metal with 7% to 8% silicon. Tungstic acid yielded a fused regulus containing, in addition to tungsten, 4·97% iron, 0·93% carbon, and 2·26% silicon. Wolframite, FeO,WO_3, gave a partially fused 97·5% tungsten. Powdered rutile gave a brittle regulus of titanium containing 20·37% silicon and nearly 3% iron. Molybdic acid yielded a brittle, partially fused metal containing 3·24% silicon, 6·41% iron, and 0·64% carbon.
T. E.

Use of Sodium as a Desiccating Agent for Gases. Camille Matignon (*Bull. Soc. chim.*, 1908, [iv], **3**, 353—355).—Rosenfeld has shown (Abstr., 1901, ii, 547) that finely-divided preparations of sodium or potassium may be obtained by grinding up the metal with sodium chloride. The author finds such a preparation of sodium useful as a drying agent for ammonia and similar gases in cases where the presence of a small amount of hydrogen in the dried gas is not objectionable. Perfectly dry ammonia can be obtained by heating ammonia solution and passing the evolved gas, first over soda-lime and then over metallic sodium which has been ground up with fused sodium chloride. T. A. H.

Specific Gravities of the Iodides of Sodium, Potassium, Rubidium, Cæsium, Calcium, Strontium, and Barium. Gregory P. Baxter and Francis Newton Brink (*J. Amer. Chem. Soc.*, 1908, **30**, 46—53).—The sp. gr. of lithium iodide has been determined already (Baxter, Abstr., 1904, ii, 484).

Determinations of the sp. gr. of several other iodides have now been made, the salts being fused previously in an atmosphere of nitrogen. The pyknometer employed has been described by Baxter and Hines (Abstr., 1904, ii, 257). The results for D_4^{25} are as follows: Sodium iodide, 3·665; potassium iodide, 3·115; rubidium iodide, 3·438; cæsium iodide, 4·510; calcium iodide, 3·956; strontium iodide, 4·549; barium iodide, 5·150. E. G.

Preparation of Chemically-active Silver by Electrolysis N. Tananaeff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 197—203) —Silver, even when obtained electrolytically, varies greatly in its chemical reactivity according to the conditions of the experiment. The most active product is obtained by using a solution of 1·5 grams of silver nitrate in 100 c.c. of water to which about 5 c.c. of dilute nitric acid are added, and heating it to about 40° before starting the experiment; the vessel consists of a porous clay cylinder placed within an outer shallower vessel, the electrodes being platinum plates of 4 sq. cm., of which the cathode is placed in the cylinder at a depth of not more than 1 cm. below the liquid and is kept perfectly motionless throughout the electrolysis. The anode is placed in the outer vessel. The silver so obtained need not be heated in a stream of hydrogen, as it is perfectly free from oxides (compare Danneel, Abstr., 1900, ii, 467) and is also perfectly amorphous. At higher concentrations, it is partly crystalline, whilst at 20% concentration it is wholly so. The activity is measured by its action on ferric sulphate. Z. K.

Latent Photographic Image as a Colloidal Compound. Lüppo-Cramer (*Chem. Zentr.*, 1908, i, 93; from *Zeitsch. Chem. Ind. Kolloide*, 1907, 2, 135—138).—A study has been made of the combination of metallic silver with silver halides. When colloidal silver and silver chloride or bromide are mixed, a colour change and a flocculent separation takes place. Nitric acid dissolves the excess of silver from the precipitate, leaving an intensely red photo-halide. The photo-chloride is more easily prepared than the bromide, and is inert in much smaller particles towards oxidising agents. This photo-halide is only produced so long as the silver is in the colloidal state. The formation of silver sub-chloride or -bromide assumed by Lea is not supported by experiment, and is shown by the author to be unnecessary. J. V. E.

Relative Solubility of the Silver Halides and Silver Thiocyanate. Arthur E. Hill (*J. Amer. Chem. Soc.*, 1908, **30**, 68—74, 303).—The relative solubility of two sparingly soluble salts can be determined whenever (1) the concentrations of the free ions can be calculated from the total concentration of the substances in solution as estimated analytically, and (2) the degree of dissociation of the two salts in saturated solution is known, so that the total solubility can be calculated for the solubility products. The relative solubility of the silver halides and silver thiocyanate has been determined on these lines with the following results.

The solubility of silver chloride being taken as unity, the relative solubilities at 25° are: $AgCl : AgCNS : AgBr : AgI = 1{\cdot}00000 : 0{\cdot}07480 : 0{\cdot}05500 : 0{\cdot}00077$. Accepting Kohlrausch and Rose's value for the solubility of silver chloride, the absolute solubilities of the salts at 25° are: $AgCl$, $1{\cdot}6 \times 10^{-5}$; $AgCNS$, $1{\cdot}2 \times 10^{-6}$; $AgBr$, $8{\cdot}8 \times 10^{-7}$; AgI, $1{\cdot}23 \times 10^{-8}$. E. G.

So-called Silver Peroxide. G. Baborovský and B. Kuzma (*Zeitsch. Elektrochem.*, 1908, **14**, 196—197).—A solution of silver nitrate is electrolysed with an anodic current density of 0·07 ampere per sq. cm. at platinum electrodes separated by a porous cell. A crystalline, insoluble substance is formed at the anode which contains one molecule of nitric acid for each atom of silver, and two molecules of free nitric acid are also formed at the anode for each atom of silver in the precipitate, $3AgNO_3 + H_2O = 2Ag + 2HNO_3 + AgNO_4$. The silver pernitrate is very unstable, and soon decomposes into the substances which have been described as silver peroxide. T. E.

Potassium Silver Silicomolybdate. H. Copaux (*Bull. Soc. franç. Min.*, 1907, **30**, 292—299).—A solution containing potassium silicomolybdate, silicomolybdic acid, and silver nitrate deposits first a white precipitate and, on evaporation, crystals with the composition $2(SiO_2,12MoO_3),3Ag_2O,K_2O + nH_2O$. The amount of water of crystallisation depends on the temperature at which the solution is evaporated: at 18—20°, red, triclinic crystals containing $14H_2O$ are deposited; and at 12—14°, yellow, triclinic crystals containing $30H_2O$. Yellow, crystalline crusts with $22H_2O$ were also formed. The red colour of one of these hydrates is unusual for a silicomolybdate, which are characteristically yellow in colour. L. J. S.

Preparation of Alkaline-earth Metals. Fr. von Kügelgen (*Zeitsch. Elektrochem.*, 1908, **14**, 143—144).—The essential feature of the author's patented process for making calcium and strontium is the use of an immersed cathode and an electrolyte heavier than the metal, so that the globules of fused metal separate quickly from the cathode, where the temperature is highest, and float up to the surface, where the temperature is kept down by means of a cooling ring. T. E.

Action of Metallic Calcium and Calcium Hydride on Metallic Oxides, Sulphides, and Halogen Salts. F. Mollwo Perkin and Lionel Pratt (*Trans. Faraday Soc.*, 1908, **3**, 179—186. Compare Abstr., 1907, ii, 952).—Calcium hydride reduces cupric oxide, manganese peroxide, ferric oxide, stannic oxide, litharge, tungstic oxide, boron trioxide, and silica. The reactions are not so violent as when calcium is used. Zinc oxide is not attacked. Lead and antimony sulphides react, but little metal is produced; a calcium antimony (or lead) sulphide may be formed.

Metallic calcium reduces tungsten trioxide very vigorously, both the metal and the calcium oxide produced being fused; with titanium oxide, the temperature does not rise so high, the titanium being obtained as a powder. Alumina is also reduced, but globules of metal are not obtained.

Strontium oxide and metallic calcium react readily, but no metal is obtained; by heating calcium with quicklime, the metal disappears; it appears probable that in these cases a sub-oxide is formed.

The hydroxides of the alkali and alkaline-earth metals react vigorously with calcium, but the metals could not be obtained.

By heating calcium with barium or strontium chloride in the proportion 2Ca to $BaCl_2$ or $SrCl_2$, alloys of barium or strontium with calcium are formed. The chlorides of the alkali metals are also reduced, but the metals volatilise and burn. Lead chloride reacts explosively, forming an alloy. Aluminium chloride gives a small yield of an alloy. Calcium and sulphur, fired by a taper, react almost explosively, but with calcium hydride the reaction is under control, yielding calcium sulphide and hydrogen sulphide. A mixture of calcium hydride and red phosphorus cannot be ignited by a fuse, but, if some metallic calcium is added, the reaction leads to red calcium phosphide. Calcium hydride and selenium yield calcium selenide.

T. E.

Reaction between Lime and Sulphur. R. W. THATCHER (*J. Amer. Chem. Soc.*, 1908, **30**, 63—68).—An account of the composition of solutions formed by boiling mixtures of water, lime, and sulphur, which are largely used as insecticides in agricultural practice (compare Haywood, Abstr., 1905, ii, 312). The solutions contain chiefly calcium pentasulphide and thiosulphate, together with small quantities of sulphite and sulphate. When freshly-slaked lime and sulphur are boiled with water in open vessels, either in presence or absence of salt, they dissolve in the proportions of 1 part CaO to 1·94 parts S when the lime is in excess, or 1 part CaO to 2·24 parts S if the sulphur is in excess. The ratio of the sulphur appearing as pentasulphide to that appearing as thiosulphate is always about 1 : 5. If such solutions are left for several days, they sometimes deposit bright red or yellow crystals of calcium oxysulphides, formed by the union of the excess of calcium hydroxide with some of the pentasulphide.

The results of analyses of concentrated lime-sulphur solutions are recorded. The proportion of sulphur as pentasulphide is much greater in these solutions than in those prepared in open vessels. E. G.

Abnormal Behaviour of Salts of Zinc, Magnesium, Thorium, Cerium, Nickel, and Cobalt on Hydrolysis. HENRY G. DENHAM (*Zeitsch. anorg. Chem.*, 1908, **57**, 378—394).—The degree of hydrolysis of the salts in question, in different dilutions and in some cases at different temperatures, has been determined by measuring the $H^{\cdot}$ ion concentration with a hydrogen electrode. In many cases, the $H^{\cdot}$ ion concentration of the solutions alters irregularly from day to day and does not appear to attain an equilibrium value; this behaviour is probably connected with the presence of colloidal salts or hydroxides in solution.

For $M/8$ and $M/4$ solutions of zinc sulphate, the potential difference between metal and solution varies irregularly from day to day over a range of about 0·05 volt at 25°; the same is true of solutions of zinc chloride. Measurements have been made at intervals of temperature between 25° and 95°, and it is found that at the same temperature the $H^{\cdot}$ ion concentration is less with falling than with rising temperature, showing that the original solutions were not in true equilibrium, but in some way "over hydrolysed." As confirming the view that the phenomena in question are connected with formation of colloidal solutions, it is found that, when a solution of zinc sulphate is heated to 100° and again cooled to 25°, the *E.M.F.* is not much altered, but a slight colloidal precipitate is noticed.

Magnesium sulphate shows the same phenomenon, a 1/32 molar solution is hydrolysed only to the extent of about 0·0023%. For thorium sulphate, the $H^{\cdot}$ ion concentration rises steadily for seven to eight days and then falls, the average hydrolysis of a 1/64 molar solution is 46%. A 1/32 molar solution of cerium chloride, $CeCl_3$, is hydrolysed about 0·14%. For cobalt chlorides, the daily variation is small; the average hydrolysis in a 1/32 molar solution is 0·17%. Like zinc sulphate, the hydrolysis of the latter salt is greater with rising than with falling temperature, and the difference at 50° is as much as 54%. For nickel sulphate, the daily alteration in hydrolysis is very small. G. S.

Electrolytic Corrosion of Copper-Aluminium Alloys. W. S. Rowland (*J. Physical Chem.*, 1908, **12**, 180—206. Compare, for the composition of the alloys, Curry, Abstr., 1907, ii, 872).—A series of copper-aluminium alloys, containing 0—100% of copper, were annealed at 500°, and those containing 0—54% and 84—100% of copper quenched from that temperature; the remainder, owing to their brittle character, had to be cooled slowly. Alloys containing 84—90% of copper were also annealed at 610°. The alloys were then subjected to electrolytic corrosion in solutions of certain sodium salts, a test piece being used as anode, a platinum wire as cathode, and a small electric current passed through the solution. The amount and copper content of the corrosion products, as well as the current efficiency, are given in tabular form, and in most cases the current efficiency is also represented graphically as a function of the composition of the alloys.

The alloys are practically unacted on in sodium carbonate solution; sodium hydroxide dissolves the $CuAl_2$ and η phases, but not the α, β, and ϵ phases. The α phase is most readily soluble in the majority of the organic salt solutions, but the $CuAl_2$ and η phases are unacted on in contact with these solvents. In alkaline tartrate solutions, the solubility increases from the α to the γ phase and then diminishes. The alloys which are most resistant to corrosion in general have the poorest physical properties. Only those containing 10—20% of copper are suitable for commercial use.

In many of the solutions, especially those containing organic salts, the alloys tend to become passive, the aluminium at the same time becoming superficially oxidised. G. S.

Physico-chemical Investigation of Old Bronzes from the Excavations in Lalajants, on the S.W. Shore of Lake Gontscher, in the Summer of 1906. Vladimir A. Skinder (*Chem. Zentr.*, 1908, i, 220; from *Mitt. Kaukasisch. Museum*, 1907, **3**, 1—60).—The author discusses the relation between the properties of bronzes and their chemical composition, and also the alteration which bronze objects undergo when under water or buried in the earth. In both cases, they become coated with a film of copper sulphide, owing to the presence of free hydrogen sulphide. The inner surface of two of the bronze objects examined was found to be coated with a thin film of atacamite, $3CuO,CuCl_2,NH_2O$. Many results of the analysis of bronze objects are given, and from them the conclusion is drawn that the hardening of bronze was known to the ancients. J. V. E.

Synthesis of Atacamite. Vladimir A. Skinder (*Bull. Acad. Sci. St. Petersbury*, 1908, **3**, 381—388).—The chemical and microscopical examination of the deposits found on ancient bronzes that have been long buried (preceding abstract), shows that the quantity of atacamite in them is very inconsiderable, this being due (as proved by its synthesis) to the extreme slowness with which atacamite is formed. The proportion of atacamite, however, also depends on the quality of the soil in which the bronze is buried and on the climate. The process by which atacamite is synthesised is best explained by Berthelot's equations (*Ann. Chim. Phys.*, 1895, [vi], 4, 551). Z. K.

The Three-Component System CuO, SO_3, H_2O at 25°. JAMES M. BELL and WALTER C. TABER (*J. Physical Chem.*, 1908, **12**, 171—179).—No evidence has been obtained of the existence of definite basic or acid sulphates of copper at 25°.

In order to determine whether any of the basic sulphates of copper described in the literature actually exist, solutions of copper sulphate have been shaken with copper oxide or hydroxide in varying proportions at 25° until equilibrium was attained, and the solutions and residues then analysed. The equilibrium solutions all contained copper oxide and sulphur trioxide in equivalent proportions. The results show that definite basic sulphates of copper do not exist; the residues consist of solid solutions of copper oxide and sulphate. The composition of the limiting solid solution in contact with water is $4CuO,SO_3$, which is that of the "basic sulphate" obtained by Pickering (Trans., 1907, **91**, 1981) by the action of not more than 0·75 equivalent of alkali on a solution of copper sulphate.

When sulphuric acid in gradually increasing concentration is added to solutions of copper sulphate, the solubility of the latter is lessened, and the three hydrates, $CuSO_4,5H_2O$, $CuSO_4,3H_2O$, $CuSO_4,H_2O$, and, finally, the anhydrous salt are obtained successively as solid phases. The hydrates with $5H_2O$ and $3H_2O$ are in equilibrium with a solution containing 41·29% of sulphur trioxide and 1·42% of copper oxide, the vapour pressure of which is about 8·5 mm. at 25°, and the hydrates with $3H_2O$ and $1H_2O$ are in equilibrium at the same temperature with a 48·5% solution of sulphur trioxide, the vapour pressure of which is about 4·5 mm.; finally, the transition $CuSO_4,H_2O \rightarrow CuSO_4$ takes place at about 0·1 mm. pressure. These transition pressures are in moderate agreement with those determined directly by Lescoeur (Abstr., 1886, 842).

No evidence has been obtained of the existence of hydrates other than those mentioned. G. S.

Purification of Mercury. WILLIAM BETTEL (*Chem. News*, 1908, **97**, 158).—It is found that mercury can be freed from gold, zinc, tin, lead, copper, and iron by treatment with dilute potassium cyanide solution in the presence of sodium peroxide. The metal (7 kilos.) is placed in a shallow enamelled iron pan, thus exposing a maximum surface to the cyanide solution, which consists of 1·5 litres of a 2% solution of potassium cyanide (98%). Twenty grams of peroxide are added at intervals in order to facilitate the oxidation of the base metals, and the whole is agitated gently at intervals. During the first four days, the base metals are removed, and at the end of about fourteen days the whole of the gold if, after eight days, the above solution is removed and replaced by one of one-tenth its concentration.

The mercury, after this treatment, is purer than that usually obtained by distillation under reduced pressure. J. J. S.

Ammoniacal Dimercuriammonium Chlorides. H. GAUDECHON (*Compt. rend.*, 1908, **146**, 761—764. Compare this vol., ii, 85).—By the action of liquid or dry gaseous ammonia at 10—15° on the chloride, NHg_2Cl,H_2O, an amorphous, canary-yellow *compound* of the composition $(NHg_2Cl)_2,NH_3$ is formed. The same substance is produced by the action of liquid ammonia on the oxychloride, $3HgO,HgCl_2$, and by the prolonged action of alcoholic ammonia on the chloride, NHg_2Cl,H_2O. The latter, for the preparation of the new compound, should be obtained at a low temperature, washed with cold water, and dried in a vacuum over phosphoric oxide. The substance, $2NHg_2Cl,NH_3$, is only very slowly decomposed by concentrated aqueous ammonia; it is hydrolysed by water at 15° into ammonia and the chloride, NHg_2Cl,H_2O. The latter, however, is not altered by prolonged contact with concentrated aqueous ammonia. Cold potassium hydroxide solution liberates ammonia from the compound

$$2NHg_2Cl,NH_3,$$

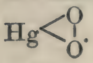
and, on heating, gives the brown, crystalline mercuric oxide, ammonia, and potassium chloride. The new substance is decomposed by dilute hydrochloric acid into NHg_2Cl,H_2O (2 mols.) and NH_4Cl (1 mol.), which slowly combine, giving NHg_2Cl,NH_4Cl. Dissolution of $2NHg_2Cl,NH_3$ (solid) in 24KCN develops $+121{\cdot}5$ Cal. From this, the heat developed by the reaction $2NHg_2Cl,H_2O$ (solid) + NH_3 (gas) = $(NHg_2Cl)_2,NH_3$ (solid) + $2H_2O$ (liquid) is calculated as $+10{\cdot}2$ Cal., or $+5{\cdot}9$ Cal. (liquid ammonia), $+1{\cdot}4$ Cal. (dissolved ammonia). Deducing by analogy the value $+3{\cdot}3$ Cal. for the heat of combination of $2NHg_2Cl$ with $2H_2O$ (solid), the value $+13{\cdot}5$ Cal. is obtained for the heat of formation of NHg_2Cl(solid),NH_3(gas).

The compound $(NHg_2Cl)_2,NH_3$ combines with a further molecule of ammonia at 0°, and a study of the system $(NHg_2Cl)_2,NH_3$(solid) + NH_3(gas) shows that it obeys the law of fixed tensions, the equilibrium pressures of ammonia being 21 cm. at −21°, 38 cm. at 0°, 62 cm. at +8°, and, by extrapolation, 76 cm. at 13°. Application of Matignon's law as to the constant variation in the entropy of similar systems (Abstr., 1899, ii, 273) gives the value $+9{\cdot}4$ Cal. for the heat of combination of the second molecule of ammonia.

The compounds $(NHg_2Cl)_2,NH_3$ and NHg_2Cl,NH_3 can be regarded as ammoniacal dimercuriammonium chlorides, in which the group NHg_2Cl behaves as a true metallic chloride, whilst Rammelsberg's compound NHg_2Cl,NH_4Cl can be considered as the hydrochloride of the substance NHg_2Cl,NH_3, and written thus: $[(NHg_2Cl)NH_3]HCl$. E. H.

Mercury Salts of Hydrogen Peroxide and the Preparation of a Compound HgO_2. ANDREAS VON ANTROPOFF (*J. pr. Chem.*, 1908, [ii], **77**, 273—320).—In the periodic contact catalysis of hydrogen peroxide by mercury (Bredig and Weinmayr, Abstr., 1903, ii, 279; Bredig and Wilke, 1905, ii, 151), the formation of a yellow or brownish-black skin has been observed when the evolution of oxygen ceases. It is highly probable that this is an intermediate product of the type Hg_xO_y formed during the catalysis. It has not been found possible to isolate and analyse the skin, on account of the readiness with which it is decomposed, sometimes explosively, into mercury and oxygen, but the conclusion is drawn that it is the mercurous salt of hydrogen peroxide or *mercurous peroxydate.*

When the skin is left in contact with concentrated hydrogen peroxide, it is transformed into an explosive, brownish-red compound, which can be prepared more readily by the action of hydrogen peroxide (30%) on red mercuric oxide.

Careful synthesis and analyses, by van Bylert's method, of the red compound show that it has the composition HgO_2, and it is regarded as the mercuric salt of hydrogen peroxide, that is, *mercuric peroxydate,*  $\mathrm{Hg}<\begin{matrix}\mathrm{O}\\ | \\ \mathrm{O}\end{matrix}$. It decomposes rapidly when in contact with water at the ordinary temperature with evolution of oxygen. It is slowly hydrolysed by water at 0°; the washings contain free hydrogen peroxide, and mercuric oxide is formed ultimately. The dark red compound is not formed when the red oxide is left in contact with hydrogen peroxide of 15% or less concentrated, although even in these cases evolution of oxygen occurs after some little time. The peroxydate is formed more readily at the ordinary temperature than at 0°, but this is followed by vigorous decomposition in the course of twenty to fifty minutes, whereas at 0° decomposition occurs after three to seven days. The decomposition is accelerated by traces of alkali, but retarded by acids. Yellow mercuric oxide cannot be used in place of the red oxide, but, if the red oxide is powdered until it has a yellow colour, it reacts readily with hydrogen peroxide; the product formed has a paler colour, and decomposes much more readily that the product from the ordinary red oxide. When dry, the compound is comparatively stable, even at the ordinary temperature. It can undergo rapid decomposition, leaving a grey residue; this usually occurs at the beginning of drying; or it can decompose slowly, giving up oxygen and leaving a residue of red mercuric oxide. When heated or struck, it explodes, and the product obtained from the finely-powdered oxide explodes when rubbed, even in the moist state. Daylight has no apparent effect on the decomposition of the dry powder.

Some specimens of red oxide immediately decompose the hydrogen peroxide with evolution of oxygen, but the addition of a minute quantity of nitric acid will prevent this and induce the formation of the peroxydate. The compound cannot be obtained by the action of hydrogen peroxide on mercuric acetate, or by the action of ozone on mercury or mercuric oxide.

Mercurous oxide reacts with hydrogen peroxide with explosive violence even in the presence of free acid; after repeated additions of peroxide, the reaction ceases, and the black oxide assumes a dark red colour, due to the formation of mercuric peroxydate.

J. J. S.

Double Nitrates of Alkali and Cerium Metals. GRÉGOIRE WYROUBOFF (*Bull. Soc. franç. Min.*, 1907, **30**, 299—323).—Crystallographic descriptions are given of the following salts:

$3Ce(NO_3)_2,4RbNO_3,8H_2O$; $3La(NO_3)_2,4RbNO_3,8H_2O$;
$3Di(NO_3)_2,4RbNO_3,8H_2O$; $3Ce(NO_3)_2,4CsNO_3,5H_2O$;
$3La(NO_3)_2,4CsNO_3,5H_2O$; $3La(NO_3)_2,4KNO_3,4\frac{1}{2}H_2O$;
$3La(NO_3)_2,4NaNO_3,3H_2O$;

and the pyridine salt, $3Ce(NO_3)_2,4(C_5H_5N,HNO_3),7H_2O$.

When the solutions of these salts are evaporated at temperatures above 70°, the anhydrous salts (except the sodium salt) are deposited as cubic crystals. Mixed crystals of some of these salts are described.

L. J. S.

Cerium Selenates. MASANIELLO CINGOLANI (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 254—266*).—The author has prepared anhydrous cerous selenate, $Ce_2(SeO_4)_3$, and the hydrates containing 4, 5, 7, 8, 10, 11 and 12 H_2O. All these hydrates, like the corresponding hydrated sulphates, are very unstable. The properties of the various hydrates are given.

The tetrahydrate, $Ce_2(SeO_4)_3,4H_2O$, forms hexagonal prisms belonging to the rhombic system [A. Rosati: $a:b = 0{\cdot}6834:1$].

The solubility of the anhydrous selenate is given in tabular and curve form, the latter undergoing various changes of direction.

T. H. P.

Yttrium Earths. I. VICTOR LENHER [and, in part, R. C. BENNER] (*J. Amer. Chem. Soc.*, 1908, **30**, 572—577. Compare James, Abstr., 1907, ii, 467).—The earths of the yttrium group, obtained from samarskite, may be fairly readily separated by repeated fractional precipitation of the hot neutral solution of the nitrates with sodium succinate. In this way are finally obtained (1) a most soluble fraction, the atomic weight of the element in which is 93, consisting chiefly of yttrium with small amounts of samarium, europium, and holmium; (2) a least soluble fraction, the oxide of which is yellow, atomic weight 139, and which is undoubtedly a mixture of yttrium with terbium, holmium, europium, and erbium.

W. H. G.

Action of Aluminium Powder on Silica and Boric Anhydride. FRANK E. WESTON and H. RUSSELL ELLIS (*Trans. Faraday Soc.*, 1908, **3**, 170—178).—Fine aluminium powder and powdered boron trioxide, mixed in the proportion $2Al:B_2O_3$, react in the cold when a fuse of barium dioxide and magnesium ribbon is used; with coarser powder, or when a mixture containing twice as much boron trioxide is used, the reaction only takes place at a red heat. By boiling the product with hydrochloric or hydrofluoric acid, or by fusion with borax and extraction with water, a residue is obtained which consists mainly of boron mixed with borides of aluminium, and alumina. When treated with chlorine, this residue yields boron trichloride, aluminium chloride, and boron trioxide, the latter substances being formed thus: $2BCl_3 + Al_2O_3 = 2AlCl_3 + B_2O_3$. The yield of boron trichloride is poor.

Silica and aluminium powder, mixed in the proportion $8Al:3SiO_2$, react in the cold when kieselguhr or precipitated silica is used; a higher temperature is required for sand or when other proportions are used. Amorphous silicon is always formed. T. E.

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* and *Gazzetta*, 1908, **38**, i, 292—307.

Utilisation of Leucite. Camillo Manuelli (*Gazzetta*, 1908, **38**, i, 143—152).—The author discusses the various processes suggested for the industrial application of leucite. The following methods of treatment give the most promising results. The mineral is converted into alum by the action of dilute sulphuric acid. The alum is then either (1) heated with wood charcoal at a dull red heat, by which means it yields potassium and aluminium sulphides; the latter can then be converted into aluminium hydroxide by the action of water and separated; or (2) heated alone at 450°, the products being potassium sulphate, alumina, and sulphur trioxide; or (3) treated with calcium carbonate, which also removes the alumina. Leucite may also be treated profitably with nitric acid, the reaction being represented by the equation: $Al_2(SiO_3)_3,K_2SiO_3 + 8HNO_3 = 2KNO_3 + 2Al(NO_3)_3 + 4SiO_2 + 4H_2O$; the aluminium nitrate may then be converted into potassium nitrate by treatment with potassium chloride. T. H. P.

Some New Compounds of Indium. Frank C. Mathers and C. G. Schluederberg (*J. Amer. Chem. Soc.*, 1908, **30**, 211—215).—*Indium perchlorate*, $In(ClO_4)_3,8H_2O$, obtained by dissolving indium in perchloric acid, is a colourless, crystalline, deliquescent salt which fuses at 80°. The *iodate*, $In(IO_3)_3$, prepared by the action of potassium iodate on indium trichloride, forms white crystals, and is soluble in 1500 parts of water at 20°, or in 150 parts of nitric acid (1:5) at 80°. The *selenate*, $In_2(SeO_4)_3,10H_2O$, obtained by dissolving indium hydroxide in selenic acid, forms white, hygroscopic crystals, and is easily soluble in water. *Indium caesium selenate*, $CsIn(SeO_4)_2,12H_2O$, crystallises from a solution of cæsium and indium selenates in colourless, efflorescent octahedra. E. G.

Silicotungstates of Indium. Grégoire Wyrouboff (*Bull. Soc. franç. Min.*, 1907, **30**, 277—282).—Metallic indium was dissolved in nitric acid and the theoretical amount of silicotungstic acid added to the solution; the nitric acid was driven off by evaporating to dryness, and the neutral solution crystallised over sulphuric acid at 15°. The large, colourless crystals so obtained are isotropic octahedra, with the composition $3(12WO_3,SiO_2),2In_2O_3,93H_2O$.

In an acid solution at a higher temperature, anorthic crystals with $63H_2O$ were first obtained, and afterwards monoclinic crystals of an acid salt with the composition

$$3(12WO_3,SiO_2),2In_2O_3,12WO_3,SiO_2,2H_2O,80H_2O.$$

Indium is therefore tervalent, and the silicotungstate of its sesquioxide is analogous to those of iron, aluminium, chromium, gallium, and glucinium, with the difference, however, that none of these give an acid silicotungstate. L. J. S.

Specific Heat of Iron-Carbon Alloys. P. Oberhoffer and A. Meuthen (*Metallurgie*, 1908, **5**, 173—177).—The vacuum calorimeter employed in the determination of the specific heat of iron (Abstr., 1907, ii, 736) has been improved in several respects.

Alloys containing from 0—4·03% C were examined at 650°, the whole of the carbon being present as cementite. The specific heat between 0° and 650° is directly proportional to the carbon content, increasing by 0·0011 for each 0·5% C. Extrapolation gives the value 0·1581 for the specific heat of the carbide, Fe_3C, the theoretical value, calculated from the atomic heats, being 0·1546. C. H. D.

Electrolytic Inactivityof Ferric Oxide. PETERS (*Chem. Zentr.*, 1908, i, 213—214; from *Zentr. Akkumulat.*, 1907, **8**, 165—166).—Contrary to the statement that chemically-prepared ferric oxide is difficult to reduce electrolytically (D.R.-P. 180672 and 190236), on comparing the capacity of accumulators containing negative plates of artificial and natural ferric oxide, no evidence of electrolytic inactivity is observed. J. V. E.

Freezing-point Curve of the Cobalt–Arsenic Alloys. K. FRIEDRICH (*Metallurgie*, 1908, **5**, 150—157).—Very pure specimens of cobalt, prepared by reduction of the oxide with hydrogen at 1100—1200°, and arsenic were melted together to form an alloy containing 45·6% of cobalt, and this was then melted with further quantities of cobalt or arsenic. The complete thermal examination by Tammann's method was made. Each melt was nucleated to prevent undercooling, although even with this precaution undercooling was sometimes observed to the extent of 20°.

The first series of crystals consist of cobalt containing not more than 1% of arsenic in solid solution. There is a eutectic point at 916° and 30% As. There is a maximum at 926° and 33·7% As, corresponding with the compound Co_5As_2. A second maximum, corresponding with the compound Co_2As, occurs at 959° and 38·9% As. The existence of Co_3As_2, dissociating without melting at 1014°, is also indicated, and the curve then rises, apparently reaching a maximum near 1180°, corresponding with the compound CoAs. It was not possible to follow the curve to higher percentages of arsenic.

The three compounds first mentioned exist each in an α- and a β-form, the transformation occurring on cooling with development of heat whether the compound is present in primary crystals or as a constituent of a eutectic. The respective transition temperatures are: for Co_5As_2, 828°; Co_2As, 352° (?), and Co_3As_2, 915°. Alloys containing from 12% to 46% As also undergo a transformation at temperatures ranging from 250° to 350°, both temperature and heat development reaching a maximum at the composition Co_2As. This change is accompanied by a considerable increase of volume on cooling, sometimes causing disruption of the alloy. Its nature is not to be discovered by a microscopic examination of the alloys.

The hardness of cobalt is progressively increased by the addition of arsenic. Only alloys containing 0—38% As are attracted by a magnet. C. H. D.

Dissociation of Chromium Oxides and of the Double Oxides of Chromium and Copper. LOTHAR WÖHLER and PAUL WÖHLER (*Zeitsch. physikal. Chem.*, 1908, **62**, 440—453).—Up to 1220°, no oxidation of chromic oxide can be detected, and it is supposed that the formation of higher oxides must be an endothermic process, taking place at higher temperatures. If chromic oxide is heated along with potassium sulphate in an atmosphere of oxygen at about 1000°, an equilibrium pressure is established, which increases when the temperature is lowered, and decreases when the temperature is raised. This is therefore a case of exothermic dissociation, and the author shows that the equilibrium is probably: $2K_2SO_4 + Cr_2O_3 + 3O \rightleftarrows 2K_2SO_4,CrO_3$. The value of the equilibrium pressure at any temperature varies with the quantity of oxygen already absorbed, probably because at 1000° potassium sulphate is fused and keeps the complex compound in solution.

The equilibrium between cupric and cuprous chromites,

$$Cr_2O_3,CuO + CuO \rightleftarrows Cr_2O_3,Cu_2O + O,$$

has been investigated. The equilibrium oxygen pressure was determined at various temperatures, and it was found that the equilibrium could be reached from both sides; the equilibrium pressure reaches the value of 1 atmosphere at 875°.

The stages of decomposition of cupric chromate on heating are represented as follows: (1) $4CuCrO_4 \longrightarrow 2Cr_2O_3,CuO + 2CuO + 3O_2$; (2) $2Cr_2O_3,CuO + 2CuO \longrightarrow 2(Cr_2O_3,Cu_2O) + O_2$. The first of these changes takes place below 400° under 1 atmosphere pressure, and some observations made by the authors tend to show that this decomposition is exothermic.

When copper chromate is heated in a current of oxygen at 650—700°, the product contains basic cupric chromite, $4Cr_2O_3,5CuO$, and cupric oxide, the former being insoluble in nitric acid. If this product is further heated to a temperature not below 900°, cuprous chromite is obtained, thus: $4Cr_2O_3,5CuO + 3CuO = 4(Cr_2O_3,Cu_2O) + 2O_2$. Cuprous chromite is insoluble in nitric acid, and can therefore be easily separated from excess of cupric oxide; its specific gravity is 5·237. By heating cuprous chromite in a current of oxygen below 870°, crystalline cupric chromite is obtained. Amorphous cupric chromite may be prepared by igniting a mixed precipitate of chromic and cupric hydroxides at about 700° in a current of oxygen.

Cuprous chromite is not attacked by sulphur dioxide; it is probable therefore that the cause of its catalytic efficiency in the contact process is a primary oxidation to $Cr_2O_3,CuO + CuO$, followed by a reduction to Cr_2O_3,Cu_2O. J. C. P.

Crystallisation of Potassium Dichromate. HENRY A. MIERS (*Min. Mag.*, 1908, 15, 39—41).—When a drop of a strong solution of potassium dichromate evaporates, there is first of all a rapid growth of branching fibres and needles at the edges of the drop; after a short time, the ends of the fibres grow slowly and uniformly as platy crystals. The first stage in the crystallisation corresponds with the "metastable" condition of the solution, and the second with the "labile" condition (Trans., 1906, **89**, 413). In the same drop there may be a recurrence of these conditions, resulting in a periodic phenomenon in the crystallisation, similar to that recently described and attributed to another cause by D. W. Alexéeff (Abstr., 1907, ii, 239). L. J. S.

Electrometric Determination of the Hydrolysis of Blue and Green Chromic Sulphates. HENRY G. DENHAM (*Zeitsch. anorg. Chem.*, 1908, **57**, 361—377. Compare Recoura, Abstr., 1896, ii, 27; Whitney, Abstr., 1896, ii, 525; Richards and Bonnet, Abstr., 1904, ii, 343).—The degree of hydrolysis of the salts in question in different dilutions at 25° has been determined from measurements of the $H^{\cdot}$ ion concentration with a hydrogen electrode (Denham, Trans., 1908, **93**, 22), and the conclusions as to the constitution of the solutions confirmed by transport and freezing-point measurements.

As regards the blue salt, the results of the measurements agree best with the assumption that the hydrolysis is represented mainly by the equation $Cr_2(SO_4)_3 + 2H_2O = 2Cr(SO_4)\cdot OH + H_2SO_4$. It therefore seems probable that the normal sulphate ionises according to the equation $Cr_2(SO_4)_3 \rightleftharpoons 2CrSO_4^{\cdot} + SO_4''$, the hydrolytic decomposition being then represented as follows: $2CrSO_4^{\cdot} + OH' \rightleftharpoons Cr(SO_4)\cdot OH$. A 1/100 molar solution of the normal blue salt is hydrolysed to the extent of 8·3% at 25°.

In order to estimate the complexity of the green salt in solution, the freezing point of aqueous solutions of the salt and of solutions saturated with chromic hydroxide and normal with regard to sulphuric acid respectively have been determined. In all cases, the depression is smaller for the green than for the blue solution, and, although the results are not quite conclusive, they appear to show that a complex cation $[Cr_4.....]$ is present. Migration experiments show that the complexity is not due to the presence of a complex acid.

Measurements of the hydrolysis in solutions of the green salt show that, contrary to the views of Recoura and of Whitney (*loc. cit.*), the salt is not hydrolysed to a definite fraction (one-sixth), but undergoes hydrolysis in the ordinary way. On the basis of the above results and of those of Richards and Bonnet (*loc. cit.*), it is considered that, on heating the blue solution, two molecules of the salt unite to form the green salt according to the equation $2Cr_2(SO_4)_3 = [Cr_4(SO_4)_4](SO_4)_2$, the latter salt then becoming partly hydrolysed. In solutions up to 1/40 molar, hydrolysis is represented by the equation

$$[Cr_4(SO_4)_4](SO_4)_2 + 2H_2O = [Cr_4(SO_4)_4]SO_4(OH)_2 + H_2SO_4;$$

on further dilution, more complete hydrolysis occurs, represented thus: $[Cr_4(SO_4)_4](SO_4)_2 + 4H_2O = Cr_4(SO_4)_4(OH)_4 + 2H_2SO_4$. G. S.

Corrosion of Tinned Containers of Preserved Food by Acids and by the Contents. KARL B. LEHMANN (*Arch. Hygiene*, 1907, **63**, 67—122).—In the absence of oxygen, tin is not dissolved by dilute acids to any appreciable extent; solution takes place most rapidly when the tin is partly in the acid and partly in the air. The rapidity with which tin is dissolved in lacquered containers depends on the amount of oxygen in the solution and above it. When oxygen is absent, its place may be taken by nitrates, generally present in well water; the nitrates are reduced to ammonia. The solution of tin on exposure to air, after the container has been opened, is not so rapid as might be expected, owing to the protective action of grease or of sugar. The action of sugar is due to a diminution in the ionisation of (tartaric) acid. The lacquering generally protects well for three to six months.

When iron has been carelessly tinned, much iron, but not more tin, is dissolved. G. B.

Antimonides of Iron and Cadmium. Nicolai S. Kurnakoff and N. S. Konstantinoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 227—249*).—The freezing-point curve for the alloys of antimony and iron consists of four branches representing four solid phases, there being eutectic points at 628° and 1·5% iron and 1002° and 49·5% iron respectively, and a transition point at 732° and 7·0% iron. The concentration of solid solutions of antimony in iron never exceeds 5%. At 1014° the compound Sb_2Fe_3 separates, and forms solid solutions in iron up to the composition 46·0% iron. The compound $FeSb_2$ at its m. p. (732°) decomposes partly, thus: $3FeSb_2 \rightleftarrows Fe_3Sb_2 + 4Sb$. In general, the antimonides of the eighth group are somewhat inert chemically, and have a tendency to form unstable compounds. In the case of the antimonides of iron and nickel, the solid substances which have escaped reaction in the liquid state retain their composition when further cooled rapidly; thus, the alloy Sb_2Fe, when cooled at the rate of 1000—300° in one to two hours, shows a microstructure composed of three elements, and only on heating an alloy of this composition for thirty hours at a temperature of 710° could the homogeneous compound Sb_2Fe be obtained. The raw antimony obtained in the commercial extraction of antimony contains Sb_2Fe in well-formed, rhombic crystals. Compounds such as FeSAs belong to the same type, the arsenic and sulphur being united directly with one another, and the structural formulæ thus obtained are in complete accord with those deduced by other methods.

As in the case of zinc and antimony (compare Schemtchuschny, Abstr., 1906, ii, 549), the freezing-point curve for cadmium and antimony takes a different form, according to the conditions of solidification, as for instance, the nature of the substance covering the metals, the stirring of the mass, the presence of corresponding crystals, &c.; the two latter conditions being necessary for the formation of stable compounds at certain concentrations. The curve corresponds with four solid phases: (1) antimony, the eutectic point being at 445° and 58·4% Sb, when crystals of the compound CdSb have been added previously, otherwise this part of the curve extends to 402° and composition 52·5% Sb. (2) The compound CdSb, which separates at 455° from liquid alloys when stirred and cooled quickly. If these alloys are allowed to cool slowly under a layer of carnalite, then the unstable compound Cd_3Sb_2 is formed. (3) The compound Cd_3Sb_2, which commences to separate at 409°. (4) Free cadmium to the eutectic point 296° and 92·5% cadmium. The alloys containing 42—52·5% antimony, when already solidified, develop heat at 260—290°, the temperature rising suddenly 20° to 30°; this occurs most markedly for alloys containing 50% antimony, and also for those still richer in antimony if crystals are not added previously and the mass is not stirred while cooling, this sudden rise in temperature being due to the compound Cd_3Sb_2 passing into a more unstable form, thus: $Cd_3Sb_2 + Sb = 3CdSb$. These views are fully confirmed by the microstructure of the various alloys, photographs of which are given. At concentration 7·5—36% antimony, the compound Cd_3Sb_2 separates whatever the conditions.

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* and *Zeitsch. anorg. Chem.* 1908, **58**, 1—22.

The crystalline structure of $FeSb_2$ and of Cd_3Sb_2 have been studied in detail by Isküll (*Zeitsch. Kryst. Min.*, 1906, **42**, 374). Cd_3Sb_2 belongs to the rhombic system [$a:b:c = 0·75909:1:0·96872$]. $FeSb_2$ also belongs to the rhombic system [$a:b:c = 0·5490:1:1·1212$, or $0·5490:1:1·1237$] (Wyrouboff). Z. K.

Bismuth Subnitrate. EDWARD J. BROWN (*Pharm. J.*, 1908, [iv], **26**, 378).—Heavy and light bismuth subnitrates are not chemically identical; the composition of the former corresponds with the formula $BiO{\cdot}NO_3,H_2O$, and that of the latter with the formula $BiO{\cdot}NO_3,\frac{1}{2}H_2O$. P. H.

Reduction of Gold Chloride by Charcoal. DAVID AVERY (*J. Soc. Chem. Ind.*, 1908, **27**, 255).—Using a very pure charcoal carefully prepared from cocoanut shell, the author has made quantitative estimations of the hydrogen chloride, and also of the carbon dioxide produced in this reaction. The conclusion is drawn that the reduction takes place by the decomposition of the water molecule with formation of the free acid of the salt, and oxidation of the charcoal to carbon dioxide, the reaction being hastened by heating. The equation proposed by König (*Chem. News*, 1882, **45**, 215) as representing the change $4AuCl_3 + 6H_2O + 3C = 4Au + 12HCl + 3CO_2$ is substantiated. Occluded gases, such as hydrogen or carbon monoxide, will also reduce gold, and possibly other metallic salts. J. V. E.

Alloys of Platinum and Tin. N. I. PODKOPÉEFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 249—260. Compare Doerinckel, Abstr., 1907, ii, 785).—Platinum and tin react energetically with one another with development of much heat, the temperature of the mass reaching 1340°. The freezing-point curve consists of six branches characterised by six crystalline substances. The first branch represents the separation of tin, and falls to a eutectic point at 224° and 15 atomic % platinum; on further addition of the latter, the curve rises steeply, giving several transition points, corresponding with the compounds Sn_4Pt, 505°, Sn_3Pt_2, 846°, possibly a polymorphous form of Sn_3Pt_2, 746°, until it reaches a maximum at 1324°, corresponding with the compound SnPt. It then falls to the eutectic point 1065° and 66·67 at. % platinum, after which it rises to a transition point 1406°, when the compound $SnPt_3$ separates. None of the compounds form solid solutions in tin or platinum. Photographs of the microstructure of the various alloys are given. Z. K.

Preparation of Chloroplatinic Acid by Electrolysis of Platinum Black. H. C. P. WEBER (*J. Amer. Chem. Soc.*, 1908, **30**, 29—31).—The work on the atomic weight of chlorine (Noyes and Weber, this vol., ii, 371) necessitated the preparation of large quantities of chloroplatinic acid free from nitric acid, and the following method was devised for the purpose.

The platinum is obtained in a suitable condition by dissolving spongy or scrap platinum in nitrohydrochloric acid, removing the excess of acid by neutralisation or evaporation, and reducing the solution with alkali formate or zinc. The precipitated platinum is warmed with a little dilute hydrochloric acid in order to remove iron, and is then transferred to the electrolytic apparatus, where it is washed and afterwards covered with concentrated hydrochloric acid. The electrodes are composed of sheet platinum. The apparatus and method are described with the aid of a diagram. On concentrating the solution of chloroplatinic acid resulting from the electrolysis, a small quantity of chlorine is introduced in order to ensure the absence of platinous compounds. E. G.

Liquid Hydrosol of Palladium Hydride. CARL PAAL and JOSEF GERUM (*Ber.*, 1908, **41**, 805—817. Compare Abstr., 1907, ii, 559).—The absorption of hydrogen by solutions of colloidal palladium prepared by the methods described by Paal and Amberger (Abstr., 1904, ii, 180 ; 1905, ii, 397) has been measured. It is found that, even with the same sample of colloidal palladium, the amount of hydrogen absorbed per unit weight of the metal varies considerably, an explanation of which cannot yet be given. Whereas palladium black was found by Mond, Ramsay, and Shields (Abstr., 1898, ii, 600) to absorb 873 times its own volume of hydrogen, colloidal palladium in solution is found to combine with 926—2952 volumes of hydrogen, after deducting the hydrogen used in combining with the oxygen present in the colloidal palladium and in the solution of the hydrosol. This great absorptivity is undoubtedly due to the very fine state of division and large absorbing surface of the metal. Paal and Amberger have shown (*loc. cit.*) that almost the whole of the hydrogen is liberated when solid palladium hydride hydrosol is heated at about 140° ; when, however, the liquid hydrosol is heated, only part of the hydrogen is evolved. Thus, in one experiment, a solution of colloidal palladium containing 0·0996 gram of the metal absorbed 14·68 c.c. of hydrogen, of which 3·88 c.c. combined with the oxygen present to form water, whilst the rest, 10·8 c.c., combined with the metal, forming the hydride ; on heating, only 4·6 c.c. of hydrogen were evolved. Why all the hydrogen is not liberated cannot yet be explained. W. H. G.

Palladium Hydride. CARL PAAL and JOSEF GERUM (*Ber.*, 1908, **41**, 818—819. Compare preceding abstract).—Paal and Amberger (Abstr., 1905, ii, 397) found that the hydride of palladium formed by the action of hydrogen on dry palladium black, when heated, liberated 674 vols. of hydrogen per unit volume of metal. The volume of hydrogen absorbed by palladium black suspended in water has been observed, and it is found that 1 vol. of the metal combines with 1204 vols. of hydrogen, or in the atomic proportion $Pd : H = 1 : 0·98$. Under these conditions, palladium black absorbs far more hydrogen than has hitherto been recorded. W. H. G.

New Stage of Oxidation of Palladium. LOTHAR WÖHLER and FRIEDRICH MARTIN (*Zeitsch. anorg. Chem.*, 1908, **57**, 398—413).—Hydrated palladium sesquioxide, Pd_2O_3,xH_2O, and certain double chlorides of tervalent palladium have been prepared, and their properties are described.

The sesquioxide is best prepared by electrolytic oxidation of platinous nitrate. A strong solution of the salt is cooled to 8° and electrolysed at a current density of 0·5 amp./cm^2 until the brown precipitate of the sesquioxide has settled out; the latter, after washing with ice-cold water, is quite pure. If the electrolysis is continued, the dioxide is ultimately obtained, most readily in acid solution. This is not a direct oxidation, but the sesquioxide decomposes into dioxide and monoxide, the latter then dissolving in the free acid and undergoing further oxidation. In accordance with this view, the sesquioxide is scarcely acted on when electrolysed in alkaline solution, as the monoxide is insoluble in alkali. The sesquioxide can also be obtained by the action of ozone on a solution of palladous nitrate.

Hydrated palladium dioxide is brown in colour and unstable; both it and the dioxide decompose under an oxygen pressure of 80 atmospheres at the ordinary temperature.

The sesquioxide is easily soluble in hydrochloric acid, but the solution is very unstable. When, however, the sesquioxide is suspended in ether in the presence of rubidium or cæsium chloride at the temperature of solid carbon dioxide and ether, and hydrogen chloride is led into the mixture, the double salts, $PdCl_3,2RbCl$ and $PdCl_3,2CsCl$, are obtained in small crystals. The rubidium double salt is greyish-green and the cæsium salt, dark green. Both decompose in contact with water, and the double palladous salts, M_2PdCl_4, are readily obtained from the solutions. When potassium chloride was used instead of rubidium or cæsium chloride, only the double salts

$$PdCl_2,2KCl$$

and $PdCl_2,4KCl$ could be isolated.

By means of the characteristic properties of the double salts, it has been shown that the trichloride is obtained both when the dichloride is oxidised by means of chlorine and when the tetrachloride is reduced (by alcohol, for example). On the other hand, the trichloride cannot be obtained by reduction of double salts of the type $PdCl_4,2MCl$. There is therefore a difference in the behaviour of the free chlorides and those forming constituents of double salts in such a way that the free energy in the reactions $PdCl_2 + PdCl_4 \dashrightarrow PdCl_3$ and

$$2K_2PdCl_5 \longrightarrow K_2PdCl_4 + K_2PdCl_6$$

diminishes in the directions indicated by the arrows. C. S.

Osmium. OSCAR MAKOWKA (*Ber.*, 1908, 41, 943—944).—A complete precipitation of metallic osmium is not effected when acetylene is passed into a dilute aqueous solution of osmium tetroxide (compare Phillips, Abstr., 1894, ii, 367). On the contrary, when acetylene dissolved in acetone is used as the precipitant, a colloidal solution of osmium is obtained, from which the metal separates completely at 100—110°. C. S.

Mineralogical Chemistry.

Mineral Chemistry. Josef Loczka (*Ann. Mus. Nat. Hungarici*, 1907, 5, 433—451).—A review of the position, methods, and aim of mineral chemistry. L. J. S.

Optical Investigation of Ramanin Naphtha. Michael A. Rakusin (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 260—276.—Compare this vol., ii, 115).—A review and criticism of previous work on this subject by other investigators is given. The fourteen samples of Ramanin naphtha studied all belong to the category of semi-transparent naphthas, and in many properties resemble the Pensylvanian naphthas, but they have D 0·854—0·889 instead of below 0·820, and their coefficient of opacity or carbonisation constant varies between $1\frac{1}{2}$—3%.

When distilled under similar conditions to those used in previous experiments, they behave quite normally, and the highest value for α in a 200 mm. tube that could be obtained is $+5°$, Engler and others obtaining α $+20°$ and above. The behaviour of the distillates towards trichloroacetic acid shows that decomposition or racemisation does not occur during distillation. The time factors in the formation of various layers of naphtha and the relation these bear to their physical and chemical properties are discussed, the conclusions drawn agreeing with those stated previously. One sample of naphtha was passed through a filter similar to those used for freeing a liquid from bacteria; thus imitating to some extent the presumed natural process, and, although the colour remained unchanged, the density changed from 0·8575 to 0·8404, and the coefficient of opacity from $1\frac{7}{8}$%—$2\frac{1}{2}$%. Z. K.

The Optically Active Constituents of Mineral Oil. Julius Marcusson (*Chem. Zeit.*, 1908, 32, 377—378, 391).—The author adduces experimental evidence in support of his theory that the optical activity of mineral oils arises from cholesterol, by distilling the unsaponifiable portions of oleins obtained from wool fat and from tallow under pressure at 300—360°; he has by this means obtained a mixture which contains all the characteristic constituents of crude mineral oil, such as optically active naphtha and lubricating oil, paraffin, and asphalt.

Neuberg's view (Abstr., 1906, i, 923; 1907, i, 577, 997), that the activity should be attributed to the decomposition of optically active amino-acids, is rendered improbable by experiments which show that amino-acids, even when mixed with fats or fatty acids of high molecular weight, are so soluble in water that they would most likely have been washed away by the water which was present during their formation in nature. Further, the fatty acids contained in proteins would be more likely to give hydrocarbons of low molecular weight, the activity of which is relatively low, whereas the actually observed increasing activity with rise of boiling point and the high activity of the lubricating oils is more in agreement with the cholesterol theory. Neuberg's objection that the amount of cholesterol in animals or plants is insufficient to account for the source of the activity is met by the argument that the protein constituents are after death destroyed by putrefaction, whereas cholesterol remains unchanged.

While not entirely disputing Zaloziecki and Klarfeld's view of terpenes or resins as being, in part, responsible for the activity, the author recalls Engler's remark that, whereas terpenes and resins might be expected to yield both dextro- and laevo-rotatory oils, actually dextrorotatory oils are almost exclusively found. P. H.

Fichtelite from Borkovic, Bohemia. FRANZ PLZÁK and V. ROSICKÝ (*Zeitsch. Kryst. Min.*, 1908, **44**, 332—343).—Pieces of pine wood from a peat bog at Borkovic are impregnated and encrusted with fichtelite. On the surface and in cavities are colourless to yellow, platy crystals 3/4 cm. across. By extracting with ether and recrystallising from alcohol, larger (several cm.), colourless, and better crystals were obtained, but these are not so rich in faces as the natural crystals. The crystals are hemimorphic-monoclinic (there being an axis of symmetry, but no plane of symmetry), as is shown by the development of the faces and by etching figures [$a:b:c=1·4330:1:1·7563$; $\beta=126°47\frac{1}{4}'$]. The material is very soft ($H<1$); D 1·01; m. p. 46°. The mean of several analyses agrees closely with the formula $C_{18}H_{32}$. The molecular weight, determined by the cryoscopic method in benzene, is 254·2 ($C_{18}H_{32}=248·32$). Oxidation with chromic acid in an acetic acid solution yielded two acids, the silver salts of which gave the formulæ $C_{15}H_{20}O_6Ag$ and $C_3H_5O_3Ag$. The ether extract from the fichtelite-bearing wood yielded also an oil which has very nearly the same composition as fichtelite. L. J. S.

Chlormanganokalite, a New Vesuvian Mineral. HENRY J. JOHNSTON-LAVIS and LEONARD J. SPENCER (*Min. Mag.*, 1908, **15**, 54—61).—The new mineral chlormanganokalite (*Nature*, 1906, **74**, 103; Abstr., 1906, ii, 455) was found as pale yellow, glassy, and highly deliquescent crystals in blocks ejected from Vesuvius during the eruption of April, 1906. A new analysis gave the following results, agreeing approximately with the formula $4KCl,MnCl_2$. The crystals are rhombohedral with $a:c=1:0·5801$; they are optically uniaxial and positive, with a refractive index of 1·59 and very low double refraction:

K.	Mn.	Cl.	Mg.	Na.	SO_4.	H_2O.	Insol.	Total.
36·34	11·52	48·13	0·04	0·38	0·81	1·52	0·71	99·45

The supposed new mineral chlornatrokalite (*Nature*, 1906, **74**, 174), found associated with chlormanganokalite, is proved to consist of a mixture of halite and sylvite, which as large, well-formed cubic crystals are intimately grown together. Scalenohedral crystals of hæmatite also occur in the same ejected blocks; these on analysis gave 94·79% Fe_2O_3, the remainder consisting mainly of insoluble rock-fragments. L. J. S.

Covellite and Enargite from Servia. S. Stevanović (*Zeitsch. Kryst. Min.*, 1908, **44**, 349—354).—A recently discovered deposit of copper ore at Bor, in eastern Servia, consists of cupriferous iron-pyrites with a little copper-glance and covellite. The latter has the form of thin, flexible, six-sided plates of a blue colour and up to 6 mm. across. The angles and twinning of these plates prove that covellite is not hexagonal, but probably monoclinic (possibly triclinic). The apparent basal cleavage of the mineral is due to the separation of the plates along the planes of twinning. Analysis I agrees with the usual formula CuS:

	S.	Cu.	Fe.	As.	Sb.	Total.	Sp. gr.
I.	33·45	65·49	0·25	—	—	99·19	4·668
II.	33·23	49·00	—	15·88	1·54	99·65	—

Associated with the covellite are crystals of enargite (anal. II), in which some of the arsenic is replaced by antimony. L. J. S.

[Synthesis of Huantajayite and Covellite: Recent Formation of Pyrrhotite: Blue Rock-salt.] Felix Cornu (*Jahrb. Min.*, 1908, ii, 22—57).—*Synthesis of Huantajayite.*—The natural mineral from Chile consists of minute, cubic crystals of sodium and silver chlorides with 3—11% AgCl. Mixed crystals containing 92·21—94·01% AgCl have been prepared by Gossner. When an ammoniacal solution of sodium and silver chlorides was evaporated, cubic crystals with 2·39% AgCl were obtained; these are strongly birefringent, and show a division into six sectors. At the same time, crystals of sodium chloride (with the same optical anomalies) and of silver chloride were obtained, and sometimes these are grouped together in parallel position. Mixed crystals of sodium and silver chlorides were prepared by fusion.

Synthesis of Covellite.—When yellow ammonium sulphide is poured on powdered malachite, the latter is blackened, and there is a development of heat. On allowing this mixture to remain for several weeks at the ordinary temperature, the malachite is wholly converted into a bluish-black powder, consisting of cupric sulphide. This, like the natural earthy covellite, is readily oxidised in the presence of water to copper sulphate.

Recent Formation of Pyrrhotite.—A bar of iron which had lain for three years in a heap of burning refuse from a coal mine in Bohemia was coated with a radiating platy layer of pyrrhotite 1·5 cm. in thickness.

Blue Rock-salt.—A detailed account is given of the literature bearing on the blue coloration of halite and sylvite. In the Austrian salt deposits, the blue and purple rock-salt is of earlier formation than that which is colourless. The colour disappears when the mineral is heated. Similar colours may be produced artificially by heating colourless rock-salt or sylvite in the vapour of an alkali metal, the resulting colour being the same, for the same salt, whatever the vapour (sodium, lithium, &c.). The naturally blue rock-salt has an alkaline reaction, and when it is dissolved in water there is an evolution of gas. Both the naturally and the artificially coloured mineral becomes pleochroic when subjected to pressure in one direction. L. J. S.

A Remarkable Iron Ore from Bohemia. RICHARD BECK and THEODOR DÖRING (*Tsch. Min. Mitt.*, 1908, **26**, 481—486).—A large block with somewhat the appearance of a mass of meteoric iron was found in a basalt quarry at Rudelsdorf, near Brüx. The material is iron-black with a sub-metallic lustre and a red streak; it has a fine-grained, crystalline structure with some lamellæ. Analysis indicates that the material is a mixture of magnetite and magnesioferrite ($MgFe_2O_4$) with a little hæmatite. L. J. S.

Hopeite and Other Zinc Phosphates from Rhodesia. LEONARD J. SPENCER (*Min. Mag.*, 1908, **15**, 1—38).—A description is given of fifteen mineral species found in the new lead and zinc mines at Broken Hill, in North-Western Rhodesia. In addition to hopeite, two new zinc phosphates, parahopeite and tarbuttite, are described. The brilliant, water-clear crystals of hopeite occur in abundance associated with vanadinite on a bone-breccia in a cavern in the zinc and lead ore (consisting of a mixture of hemimorphite, cerussite, and limonite). They are orthorhombic [$a:b:c=0·5786:1:0·4758$], and consist of an intimate interlamination of two modifications of hopeite (α-hopeite and β-hopeite), which differ in their optical characters, specific gravity, and the rate at which water is lost with increasing temperature. Analysis I and II of α-hopeite and β-hopeite respectively agree with the formula $Zn_3P_2O_8,4H_2O$ previously deduced for artificial crystals:

	P_2O_5.	ZnO.	H_2O.	Total.	Sp. gr.	Hardness.	Optical sign.
I.	31·8	52·1	16·1	100·0	3·04	$3\frac{1}{4}$	–
II.	[31·9]	51·9	16·2	100·0	3·03	$3\frac{1}{4}$	–
III.	31·6	53·0	15·6	100·2	3·31	$3\frac{3}{4}$	+
IV.	29·2	66·6	3·8	100·6	4·12	$3\frac{3}{4}$	–

Parahopeite occurs on tarbuttite as colourless, platy, anorthic crystals with a perfect cleavage in one direction. It is harder and denser than hopeite, but has the same composition (anal. III). No water is lost at 139°, whilst from hopeite 9·2% is expelled at this temperature.

Tarbuttite is of abundant occurrence, together with crystals of pyromorphite and descloizite, on cellular limonite. The crystals are anorthic with a perfect cleavage in one direction, and vary considerably in habit and appearance; they are colourless or pale shades of yellow, red, or green. It is a basic zinc phosphate, $Zn_3P_2O_8,Zn(OH)_2$ (anal. IV), corresponding with, although not isomorphous with, the orthorhombic adamite [$Zn_3As_2O_8,Zn(OH)_2$]. The water is lost only at a red heat. Pseudomorphs of tarbuttite after calamine ($ZnCO_3$) and descloizite are described.

The material of the bones in the cavern is partly replaced by zinc and lead minerals, namely, hemimorphite, tarbuttite, hopeite, and vanadinite. L. J. S.

Phosphate Minerals from Elder Rock, South Australia. DOUGLAS MAWSON and W. T. COOKE (*Trans. Roy. Soc. South Australia*, 1907, **31**, 65—70).—A hard, yellow phosphate occurs on an isolated rock which stands up in the flat, arid district near Paratoo railway siding in South Australia. It probably represents the remains of a deposit of bird-guano from which the soluble constituents have been leached out; the latter are represented by ammonium nitrate and soluble phosphates, which penetrate the rock to a considerable depth. Two types of material are distinguished: the more abundant forms yellow, encrusting masses and is optically isotropic (anal. I, after deducting 17·30% of admixed sand), and the other consists of an aggregation of small globules, which are yellowish-brown and birefringent (anal. II, after deducting 36·72% of sand). The first approximates in composition to evansite, and the second to beraunite. The new name *paratooite* is applied to these materials, although they are clearly not simple minerals:

	P_2O_5.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	H_2O (at 120°).	H_2O (ignition).	Alkalis, &c.	Total.
I.	42·59	20·70	8·20	2·49	11·11	20·49	3·20	[1·22]	100·00
II.	27·53	11·19	38·43	3·68	—	16·41	2·76	—	100·00

L. J. S.

Strüverite and its Relation to Ilmenorutile. George T. Prior and Ferruccio Zambonini (*Min. Mag.*, 1908, **15**, 78—89).—Details of the chemical analysis of the new mineral strüverite (Abstr., 1907, ii, 364) are now given. The zircona which the mineral was at first supposed to contain has been found on further examination to consist of columbic and tantalic acids. When a mixture of columbic and tantalic acids with titanic acid (that is, a mixture of columbite, tantalite, and rutile) is fused with potassium hydrogen sulphate and the fused mass treated with cold water, a considerable amount of the columbic and tantalic acids passes into solution, whilst with a 5% solution of sulphuric acid (as is necessary when the titanium is to be estimated colorimetrically with hydrogen peroxide) practically the whole passes into solution. The experiments suggest that columbium, tantalum, and titanium readily form complex combinations, which render their analytical separation a matter of some difficulty. The final results of the analysis of strüverite are given under I, corresponding with the formula $3Fe(Ta,Cb)_2O_6,10TiO_2$ or, approximately, $FeO,(Ta,Cb)_2O_5,4TiO_2$:

	TiO_2.	Cb_2O_5.	Ta_2O_5.	FeO.	MnO.	CaO.	MgO.	Total.	Sp. gr.
I.	41·20	23·48	23·48	11·38	trace	0·51	0·17	100·22	5·59
II.	53·04	21·73	14·70	10·56	—	trace	—	100·03	5·14
III.	54·57	32·15	—	12·29	—	0·11	trace	99·12	4·64

Crystallographically, strüverite is very similar to ilmenorutile (Abstr., 1907, ii, 884), but the published analyses of the latter show no close relationship to the analysis of strüverite. It was therefore thought that, if in the earlier analyses of ilmenorutile the titanic acid had been determined gravimetrically, the amounts given for this would be too high. The titanium was therefore estimated colorimetrically in the ilmenorutile from the Ilmen Mountains, in Russia, and from Evje, in Norway (Abstr., 1907, ii, 885), and found to amount to only 53·04% and 54·50%, instead of 66·90% and 73·78%, respectively; this would increase correspondingly the amounts of the columbic and tantalic acids given in the old analyses. New analyses of ilmenorutile from the Ilmen Mountains and from Iveland, in Norway, are given under II and III respectively; these correspond approximately with the formula $FeO,Cb_2O_5,5TiO_2$, with possibly some admixture of $FeTiO_3$ or $FeTi_2O_5$.

Strüverite and ilmenorutile are very similar in crystalline form to rutile, tapiolite, and mossite, and their composition is best expressed as solid solutions of the rutile (TiO,TiO_3) and tapiolite or mossite ($Fe[(Ta,Cb)O_3]_2$) molecules. The name strüverite is reserved for those members of the series which are rich in tantalic acid, and ilmenorutile for those in which columbic acid predominates, the two minerals being related to one another as tapiolite is to mossite, and as blomstrandine to priorite (Abstr., 1907, ii, 885). L. J. S.

Chemical Constitution of a Specimen of Aeschynite. G. P. Tschernik (*Bull. Acad. Sci. St. Petersburg*, 1908, **4**, 389—395. Compare Rammelsberg, Trans., 1872, 203; Abstr., 1878, 944; Hidden, Abstr., 1881, 1110; Prior, Abstr., 1899, ii, 433).—The aeschynite examined came from Hitterö, and consisted of imperfectly formed prismatic crystals, mostly surrounded by felspar; in one case, however, the latter was found within a mass of aeschynite. The sample differed in some respects from the aeschynites described hitherto. Its constitution may be expressed by the formula: $2[2Ce_2O_3,3TiO_2],4(ThO_2,TiO_2),Y_2(CbO_3)_6,3(CaO,TiO_2),3(FeCb_2O_6),FeTa_2O_6,6TiO_2$, which agrees well with the analyses made by the author and others.

The columbic acid, after having been most carefully purified, and in which it was impossible to detect any trace of titanic or tantalic acid, gives reactions differing somewhat from those of the pure acids, and resembling to some extent those described by Hermann. None of these reactions are given by the purified metallic acids isolated from other minerals obtained specially for purposes of comparison. The conclusion is therefore drawn that the columbic acid obtained from aeschynite contains some hitherto unknown substance, which could not be isolated owing to the extremely small quantity present. Z. K.

Reyerite from Greenland. O. B. Boeggild (*Meddelelser om Grönland*, 1908, **34**, 93—114).—Under the name of gyrolite, a description is given of a scaly zeolite from Niakornat, in Greenland, but in a postscript it is recognised that the material described is identical with the reyerite of F. Cornu (Abstr., 1907, ii, 483). The crystals have the form of thin, six-sided plates with a perfect basal cleavage and pearly lustre; they are rhombohedral, with $a : c = 1 : 1{\cdot}936$, and the etched figures on the base indicate that the symmetry is trapezohedral. The refractive indices are $\omega = 1{\cdot}5645$ and $\epsilon = 1{\cdot}5590$. Analysis by C. Christensen gave:

SiO_2.	Al_2O_3.	CaO.	Na_2O.	H_2O.	Total.	Sp. gr.
54·83	4·58	31·15	1·74	8·14	100·44	2·578

This gives the formula $2CaO,3SiO_2,1\frac{1}{2}H_2O$, a part of the calcium being replaced by aluminium and sodium, or, as one-third of the water is lost at 100°, $H_2Ca_2(SiO_3)_3,\frac{1}{2}H_2O$.

The micaceous zeolites from eight other localities in Greenland are briefly described; these have D 2·383—2·446, and are therefore to be referred to gyrolite. L. J. S.

Artificial Production of Isomorphous Silicate Mixtures. Viktor Pöschl (*Tsch. Min. Mitt.*, 1908, **26**, 413—456).—The materials employed (hedenbergite, chalybite, magnesia, calcium carbonate, and silica) were fused together in different proportions in a crucible, and the molten mass allowed to cool very slowly. Thin sections were cut from the central position of the mass, and the maximum angle ($c : \mathfrak{c}$) of optic extinction determined. Plotting the following results obtained for the diopside ($CaMgSi_2O_6$) and hedenbergite ($CaFeSi_2O_6$) series, it is seen that the physical characters (except sp. gr.) vary continuously with the composition, although the curve is not a straight line. The fall in the sp. gr. suggests that a labile modification of diopside with D 2·8 may be present in the isomorphous mixtures:

Diopside ...	100	90	80	70	60	50	40	30	0
Hedenbergite	0	10	20	30	40	50	60	70	100
Sp. gr.	3·08	2·87	2·90	2·96	2·98	3·01	3·16	3·26	3·53
M. p.*	1325°	1265°	1250°	1240°	1230°	1225°	1210°	1200°	1140°
$c : \mathfrak{c}$	32°	36°	38°	43°40′	45°50′	47°	49°20′	50°	50°30′
FeO%	0	2·40	5·00	7·03	9·98	12·57	14·87	17·07	25·00

* The higher limits only of the melting-point intervals are here quoted: for diopside, m. p. = 1300—1325°.

Enstatite ($MgSiO_3$) and diopside form an isodimorphous series similar to that given by magnesium sulphate and ferrous sulphate, the results falling on two parallel curves:

Diopside.........	100	75	60	50	40	25	0
Enstatite.........	0	25	40	50	60	75	100
Sp. gr.............	3·08	3·04	3·25	2·98	3·05	3·12	3·2 ?
M. p.	1325°	1320°	1315°	1320°	1325°	1350°	1400°
$c : \mathfrak{c}$	32°	37°	39°	0°	0°	0°	0°

Somewhat similar results were obtained in the olivine group. Isomorphous mixtures of magnesium and iron orthosilicates are formed, but between $66Mg_2SiO_4 : 34Fe_2SiO_4$ and $3Mg_2SiO_4 : 97FeSiO_4$ there is a gap in the series. Forsterite and monticellite (Mg_2SiO_4 and Ca_2SiO_4) form an isodimorphous group of mixed crystals. Mixtures of magnesium, calcium, and iron orthosilicates were also investigated.

L. J. S.

Pilolite from the Pyrenees. Georges Friedel (*Bull. Soc. franç. Min.*, 1907, **30**, 80—83).—A white, finely-fibrous and finely-felted material occurs at the side of a vein of blende in limestone at Can Pey, near Arles-sur-Tech, Pyrénées-Orientales. Analysis gave the following results (a few grains of quartz are mixed with the fibres), agreeing approximately with the formula $5SiO_2,Al_2O_3,MgO,3\frac{1}{2}H_2O$:

SiO_2.	Al_2O_3.	MgO.	CaO.	Fe_2O_3.	Total.	H_2O at 100°.	H_2O ignition.
70·28	21·64	7·56	0·24	0·38	100·10	9·96	23·66

The characters and composition of this material are the same as those of "lassallite," recently described by the same author as a new mineral (Abstr., 1901, ii, 397), and it is now recognised that this is identical with Heddle's pilolite. L. J. S.

Rhodusite from Asskys River, Siberia. WOLD. ISKÜLL (*Zeitsch. Kryst. Min.*, 1908, **44**, 370—389).—A dark blue or greyish-blue fibrous mineral from the neighbourhood of the Asskys river, in the Minussinsk district, Government Yeniseisk, gave the following analyses (made on three different specimens). The material is referred to rhodusite (Abstr., 1894, ii, 461), and may be considered as a variety of glaucophane, in which the alumina is nearly all replaced by ferric oxide. It is probably identical with the mineral from the same locality recently referred to crocidolite by P. Tschirwinsky (Abstr., 1907, ii, 705):

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
54·01	trace	0·23	15·70	9·42	0·14	1·52	10·01	6·22	0·35	2·25	99·85
54·38	trace	0·28	15·12	9·21	0·11	1·23	10·54	6·86	0·31	2·16	100·20
55·06	trace	0·18	14·54	7·17	0·09	1·17	12·30	6·52	0·23	2·44	99·69

The fibres are optically negative, with a maximum extinction of 2—3°; the pleochroism is strong; D 3·12. Most of the water is expelled only above 350°. The analyses do not seem to support the amphibole formula recently proposed by Penfield and Stanley (Abstr., 1907, ii, 102). The composition is expressed as an isomorphous mixture of two molecules, namely:

$$Na_2Fe_2Si_4O_{12},5(Mg,Fe,H_2,Ca,Mn)SiO_3.$$

Digestion with a 10% hydrochloric acid solution partly dissolves the mineral, the first of these molecules being dissolved slightly more readily than the second. L. J. S.

Jerseyite. E. GOLDSMITH (*Chem. Zentr.*, 1908, i, 291—292; from *J. Franklin Inst.*, 1907, **164**, 369—373).—The percentage composition of this supposed meteorite is found to be:

SiO_2.	TiO_2.	SnO_2.	Bi_2O_3.	CuO.	NiO.	Fe.	Al_2O_3.
42·80	1·90	0·49	0·22	0·26	2·00	44·36	4·18

CaO.	K_2O.	Na_2O.	C.	S.	P.
trace	0·92	0·80	1·84	0·34	0·12

The hardness is 6; D 3·636; and colour nearly black, but polished surface, greyish-white; it shows the Wittmanstedtian figures. J. V. E.

Physico-chemical Investigation of the Springs of Fiuggi, near Anticoli. RAFFAELO NASINI and MARIO G. LEVI (*Gazzetta*, 1908, **38**, i, 190—216. Compare Abstr., 1906, ii, 324).—The authors discuss the therapeutic value of the waters of Fiuggi in relation to their high radioactivity, their low electrical conductivity, and their rapid catalysis of hydrogen peroxide. The rocks in the neighbourhood of the springs are all radioactive, this being more especially the case with the volcanic tufa present. T. H. P.

Physiological Chemistry.

Resistance of Lack of Oxygen. WALES H. PACKARD (*Amer. J. Physiol.*, 1908, 21, 310—333).—Further experiments on the minnow (*Fundulus heteroclitis*) show that mannose injected intraperitoneally increases its resistance to lack of oxygen. As is the case with other sugars previously used (maltose, dextrose, lævulose), it probably acts as a depolariser in the processes of protoplasmic respiration. Galactose is apparently not absorbed from the body cavity. Alcohol and acetone are very toxic, especially the latter. They and pilocarpine decrease resistance to lack of oxygen.

W. D. H.

Distribution of the Salts in Hæmolysins. ALBERT WOELFEL (*Bio-Chem. J.*, 1908, 3, 146—154).—Stewart considered that the increased conductivity of blood after laking is not altogether due to a surrender of electrolytes by the corpuscles to the fluid, but rather that some alteration in the corpuscles, which allows ions to pass through them more freely, is caused by the laking process. Determinations of the ash in various circumstances do not yield results which are easy to interpret. On the whole, however, Stewart's view is confirmed; in formaldehyde-hardened corpuscles, which can be laked by saponin, there is no passage of electrolytes from them into the surrounding fluid, but there is nevertheless a rise of conductivity.

W. D. H.

Hæmagglutination and its Physical Basis. LUDWIG HIRSCHFELD (*Arch. Hygiene*, 1907, 63, 237—286).—The agglutination effect depends additively on the agglutinating power of the serum and on the agglutinability of the corpuscles, so that, when blood from a number of species is treated with any given serum, the order of susceptibility arrived at is maintained when these various kinds of blood are treated with any other serum. When treated with abrin, the same order is found to exist.

The differences in the agglutinability of blood corpuscles do not appear on the agglutination by colloids and salts of tervalent metals. Among the ions of bivalent metals, the less electro-positive have the greater agglutinating effect. In the case of zinc salts, the order of agglutinability of the different kinds of blood examined is the same as with sera and with abrin, but with less electro-positive metals there is no such agreement.

Agglutinability is regarded as depending on the intensities with which the electric charges are held by the colloidal corpuscles and the colloidal agglutinant substance. On this hypothesis, and with the help of Abegg and Bodländer's theory, some of the above conclusions can be arrived at theoretically.

G. B.

Hæmosozic Value of Blood-serum. D. McCay (*Bio-Chem. J.*, 1908, **3**, 97—118).—The term hæmosozic value indicates the constituents present which preserve the red corpuscles from solution. Expressed in terms of sodium chloride, it corresponds with the total salt concentration. An increase in hæmosozic value may be due to increase of salt, or due also to the presence of an anti-hæmolysin. The lowering of the hæmosozic power by the administration of certain drugs (sulphates, potassium salts, &c.) is an important factor in precipitating an attack of blackwater fever, and a rational indication for the prophylaxis and treatment of that disease is the raising of the hæmosozic power by the administration of such chlorides as those of quinine and sodium. W. D. H.

Dextrose in Cat's Saliva. Anton J. Carlson and J. G. Ryan (*Amer. J. Physiol.*, 1908, **21**, 301—309).—Dextrose is absent from human saliva, and even in cases of diabetes the amount present is insignificant. But in the cat it is constantly present, especially in submaxillary saliva. Variations are noted for which no adequate explanation is forthcoming, but as a general rule the amount rises with an increase of dextrose in the blood. The sugar excreted is therefore in all probability not a specific product of glandular activity, but is simply passed out from the blood. W. D. H.

Investigation of Diastases. Julius Wohlgemuth (*Biochem. Zeitsch.*, 1908, **9**, 10—43).—The author's method (this vol., ii, 443) was employed in the study of diastatic ferments, and the following conclusions are drawn. The amount of ptyalin in human saliva varies very considerably, being as a rule more abundant after taking food; but this is not always so, and the kind of food taken makes no difference. Pure gastric juice of man and dog contains no diastatic ferment, but neutralised gastric juice accelerates salivary action, owing to the sodium chloride present. This action is very considerable, and it may increase the activity of ptyalin ten- or even twenty-five-fold; it is due to the chlorine ion. Other salts containing chlorine ions act similarly. The bromine ion acts in the same way; iodine is less efficacious, and fluorine prevents the action. Alkalis (except sodium carbonate) inhibit the action. Sodium phosphate, oxalate, and acetate inhibit, and sodium nitrate, nitrite and chlorate hasten, the action; sodium sulphate is indifferent. Alanine and leucine inhibit; glycine has no effect. Intestinal juice hastens the action, owing to the salts it contains. Colloidal metals (gold, silver, copper, iron), in sufficient concentration, inhibit.

The diastatic ferment of the pancreas behaves exactly like ptyalin.

The diastatic ferment of blood-serum varies very considerably in the amount in which it is present, and behaves exactly as the other two do. The diastatic action of the liver is also due to a ferment, and does not depend on the activity of the living cells. The human placenta is permeable to diastatic ferments. W. D. H.

Chemical Composition of Gastric Juice in Children. Paul Sommerfeld (*Biochem. Zeitsch.*, 1908, **9**, 352—356).—The composition of the gastric juice produced by "mock feeding" of a child with œsophagal and gastric fistulæ was determined. Food, varied both in quantity and character, was given, and varying quantities of juice obtained. Twenty-five experiments were carried out, and the average amount of hydrochloric acid in the juice was found to be 0·4026%. The freezing point was also determined, and the average for Δ was −0·488°.

S. B. S.

Action of Alkalis in the Protein-ferment of the Gastric Juice. N. P. Tichomiroff (*Zeitsch. physiol. Chem.*, 1908, **55**, 107—139).—The addition of alkali lessens and destroys to the same degree the two functions of the protein-ferment of gastric juice, namely, those relating to the milk coagulation and protein hydrolysis. By again adding acid, it is possible to make the ferment once more active to a certain extent, especially if the neutralisation by alkali has not been absolute.

W. D. H.

Action of the Enzymes of Gastric and Pancreatic Juices on Vegetable Proteins. II. Albert Stutzer and E. Merres (*Biochem. Zeitsch.*, 1908, **9**, 244—254).—Sheep received different fodders of known nitrogenous content, and the fæces were collected quantitatively and portions subjected to the following treatments. (i) Peptic digestion in acid solution; (ii) peptic digestion followed by tryptic digestion in 0·08% sodium carbonate solution, and (iii) peptic digestion followed by tryptic digestion in 0·20% carbonate solution. In each case, the nitrogen of the undigested protein was estimated. The results were calculated in terms of the percentage of nitrogen in the original fodder. The latter was submitted directly to the same treatments as the fæces. It was found that the percentage of undigested protein after digestion of the fæces with pepsin was nearly the same as that after directly submitting the fodder to the same treatment. A like concordance was not observed when fæces and fodder were subjected to a subsequent tryptic digestion. The action of the gastric juice affords therefore the best measure of the digestibility of a given fodder.

S. B. S.

The Effect of Alcohol on Digestion. Zitowitsch (*Bied. Zentr.*, 1908, **37**, 287; from *Mitt. Militär. med. akad. Petersburg*).—In the dog, alcohol increases the secretion of the gastric juice, and is useful in cases of abnormal secretion, but not where secretion is normal. It continues for several days to affect the digestive processes; at first it depresses the secretion, but afterwards increases it, so that the total digestion period is prolonged. Besides increasing the amount of gastric juice, it increases the acidity and the amount of enzymes, but it decreases the activity of the juice; 1 to 2% of alcohol does not affect the enyzme action of the gastric juice.

E. J. R.

The Action of Alcohol on the Heat Relationships of the Animal Organisms. Erich Harnack and I. Laible (*Bied. Zentr.*, 1908, **37**, 287; from *Arch. internat. Pharmacodyn*, 15—71).—Experiments on rabbits made in Harnack's calorimeter showed that small or medium doses of alcohol caused at first a fall in the total heat production and a small lowering of the body temperature. The combustion of the alcohol in the body supplies some heat; hence during the hours in which the alcohol is acting there is a not inconsiderable sparing of combustible material. It is claimed that this action may often render alcohol useful to man. E. J. R.

Digestive Gland of the Crawfish. Harold C. Bradley (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxvi—xxxvii; *J. Biol. Chem.*, 4).—Extracts of the digestive gland of the crawfish, *Cambarus*, contain trypsin, erepsin, amylopsin, steapsin, invertase, maltase, tyrosinase, but not pepsin, lactase, citase, or chitinase. It curdles milk. The green colour of the gland is due to biliverdin, even although hæmoglobin is absent both from blood and muscle. W. D. H.

Phosphorus Metabolism in Man. Henry C. Sherman (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xli—xlii; *J. Biol. Chem.*, 4).—The data given indicate that the average amount required for the maintenance of phosphorus equilibrium in a full diet is 1·5 grams of phosphorus or 3·5 grams of phosphoric acid a day. In determining the output, both urine and fæces must be examined. W. D. H.

Effect of Castration on Metabolism. Francis H. McCrudden (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xl—xli.; *J. Biol. Chem.*, 4).—Castration of male and female dogs causes a greatly increased catabolism of nitrogen, sulphur, phosphorus, and magnesium. There was no effect on the metabolism of calcium. W. D. H.

Mineral Metabolism in Healthy and Rachitic Children. Walter Cronheim and Erich Müller (*Biochem. Zeitsch.*, 1908, 9, 76—126).—So far as nitrogenous, fatty, and calcium metabolism are concerned, sterilised milk is not inferior to raw milk as a food. The unfavourable effect of sterilised milk is due to circumstances which it is at present impossible to specify. No difference in metabolic exchanges was noted in children suffering from rickets and in healthy children. This may have been due to the fact that convalescence had set in, or, perhaps, the slow development of the infant renders conclusions difficult where experiments are confined to short periods of time, whereas in the offspring of animals, in which development is more rapid, this disadvantage is not apparent. W. D. H.

Calcium Foods in Growing Animals. Hans Aron and Karl Frese (*Biochem. Zeitsch.*, 1908, 9, 185—207).—Three series of metabolism experiments on growing dogs are given with full details; they led to the following conclusions: (1) that these animals are as well able to supply their need for calcium from the inorganic tricalcium phosphate, which is very slightly soluble, as from the calcium contained in milk; (2) sterilisation of milk makes no difference to its value as a supply of calcium to the body, and (3) the amount of calcium absorbed, whether in milk or inorganic salts, is very great, certainly over 80% of that administered. W. D. H.

Changes in Metabolism Due to the Action of Strontium. Giovanni Burgassi (*Chem. Zentr.*, 1908, i, 145; from *Arch. Farm. sperim.*, 1907, 6, 551—568).—Strontium chloride is slightly toxic to rabbits, much less so than barium chloride. It increases metabolism, so that the urine contains more nitrogen, sulphur, and phosphorus, and it renders intra-organic oxidation more energetic. G. B.

Action of Phosphorus on the Circulation of Calcium in Normal and Rachitic Children. MARIO FLAMINI (*Chem. Zentr.*, 1908, i, 659; from *Arch. Farm. sperim.*, 1907, 6, 653—663).—The administration of phosphorus increases the uptake of the calcium of milk by the tissues (bone and nervous tissues); this is especially marked if the children are rachitic. W. D. H.

Utilisation of Sugars by the Tissues. HUGH MCGUIGAN (*Amer. J. Physiol.*, 1908, **21**, 334—350).—The living muscles of an animal when perfused with solutions of dextrose, lævulose, or galactose cause rapid oxidation of the sugars. This increases when the amount of sugar is increased, or the muscles are made to contract. It ceases when the muscles die. Little or no maltose is oxidised similarly. The perfused liver also utilises the common sugars, and probably other glandular organs act in the same way. The glycogen-storing action of the liver is lost in perfusion much sooner than the sugar-destroying function. The same holds for the muscles. The glycolysis occurring in drawn blood at 40° in two hours is very slight. W. D. H.

Glycolysis. HUGH MCGUIGAN (*Amer. J. Physiol.*, 1908, **21**, 351—358).—Mixtures of muscle and pancreatic extracts are as inert in glycolysis as is the muscle extract alone. W. D. H.

Cerebro-spinal Fluid. ANASTAZY LANDAU and MIECZYSLAW HALPERN (*Biochem. Zeitsch.*, 1908, **9**, 72—75).—Analyses of nitrogen and sodium chloride in various diseased cerebro-spinal fluids are given; the differences in twenty-two cases of the former substance are not very great (0·03—0·08%), and the difference in sodium chloride are still less (0·51—0·67%). A rise in one substance is usually accompanied with a fall in the other. In meningitis there is less sodium chloride than in the other diseases examined. W. D. H.

The Egg-cases of Sharks. LOUIS HUSSAKOF and WILLIAM H. WELKER (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xliv—xlv.; *J. Biol. Chem.*, **4**)—The egg-cases of the skate (*Raja crinacea*) and the Port Jackson shark (*Heterodontus japonicus*) are mainly composed of a substance which resembles keratin, but is somewhat more soluble. The pigment is indiffusible, and was obtained in the form of reddish-black scales on desiccation; these are soluble in water; acid changes the colour to straw-yellow, and alkali to a dark brown. W. D. H.

Decomposition of Fat by Lung-tissue. NADINE SIEBER (*Zeitsch. physiol. Chem.*, 1908, **55**, 177—206).—The lung-tissue is able to liberate fatty acids from natural and artificial fats, and the activity may be estimated by the acidity produced. This is believed to be due to complex intracellular processes, but it is lessened if previously the lung has been washed free from blood. The activity of the same lung towards different fats varies; variations are also observed according to the animal employed. The results are given in tables. W. D. H.

Changes in the Nitrogenous Constituents of the Liver when the Kidneys are placed out of Action. G. Olivi (*Chem. Zentr.*, 1908, i, 55; from *Arch. Farm. sperim.*, 1907, **6**, 521—529).—In rabbits, the changed metabolism increases in the liver the amount of nitrogenous constituents precipitable by phosphotungstic acid.

G. B.

Post-mortem Autolysis. Holmes C. Jackson (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxvii—xxxix; *J. Biol. Chem.*, **4**).—Experiments on the liver show that toluene in amounts usually employed for antiseptic purposes lessens autolysis. Autolysis is greatest if the animals were well fed previously; the presence of blood in the organ makes no difference; light and darkness have no effect. The presence of disodium hydrogen phosphate or sodium dihydrogen phosphate has also no effect on the rapidity of autolysis. The latent period of two to four hours observed to occur in well fed-animals by Claypon and Schryver before autolysis began was not observed. If there was any delay, it occurred in badly-nourished animals. W. D. H.

Percentage of Iron in Fats, Lipoids, and Waxes. W. Glikin (*Ber.*, 1908, **41**, 910—915).—Nasse originally showed that iron compounds occurred in the spleen and red bone marrow of sucking animals, and it was concluded that they were iron proteins. That this is not so is shown by the fact that these iron compounds are contained in the ether extract of fats. A higher percentage of iron in bone marrow is found in young animals than in the old; thus, in a newly born pig, 1·15%, one six weeks old, 0·30%, eight weeks, 0·15%, and in old pigs, 0·03%. The decrease in the percentage of iron is almost in the same proportion as the lecithin (compare this vol., ii, 120; Abstr., 1907, ii, 566).

Iron is found in all fats from organs or tissues, in plant fats, like cacao butter, and in oils, and in waxes, such as beeswax and Japanese wax.

Iron has been found in all the specimens of cholesterol and lecithin examined, and cannot be removed from the fat by dilute hydrochloric acid. W. R.

Isolation of Carnaubic Acid from Ox-kidney. Edward K. Dunham (*J. Biol. Chem.*, 1908, **4**, 297—300).—Carnaubic acid from the kidney of the ox was identified by examination of the free acid (m. p. 72·5°) and analysis of its silver salt and ethyl ester. The cerebronic acid obtained by Thierfelder (Abstr., 1905, i, 621) is not identical with carnaubic acid, but it is of interest that such high fatty acids should be constituents of lipoids from both brain and kidney. W. D. H.

The Antagonistic Action of Adrenaline and Choline in the Suprarenal Glands. Alfred Lohmann (*Pflüger's Archiv*, 1908, **122**, 203—209).—That the adrenaline and choline of the suprarenal gland are antagonistic is true, not only for blood pressure, but also for cardiac activity and intestinal peristalsis. The diabetes which adrenaline produces is not, however, prevented by choline.

W. D. H.

Extra-intestinal Origin of Hydrobilirubin. A. E. AUSTIN and MABEL D. ORDWAY (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxii—xxxiii; *J. Biol. Chem.*, 4).—Stercobilin and urobilin are regarded as identical; apparently hydrobilirubin is regarded as the same substance, although it is not explicitly stated so in the paper. Urobilin normally originates from bilirubin by reduction and hydration in the intestine through bacterial action. The facts of disease show that, in the absence of bile in the intestine, urobilin may originate extra-intestinally by the action of the tissues and blood on bilirubin. Attempts to effect the change *in vitro*, however, failed. W. D. H.

Alleged Formation of Bile Pigments and Bile Acids by the Action of Trypsin on Hæmoglobin. FREDERICK S. HOLLIS (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxiii—xxxv; *J. Biol. Chem.*, 4).—Croftan (*Pflüger's Archiv*, 1902, **90**, 685) states that the formation of bile acids and pigments is a purely chemical process due to the action of trypsin on hæmoglobin in the presence of dextrose, and is not the result of specific hepatic action. The present experiments do not confirm this view; tests for bile acids were uniformly negative; Gmelin's test for bile pigments was, however, positive, but answered equally well if trypsin and dextrose were omitted, especially if bacterial growth had not been excluded. Blood laked by ether and allowed to stand gives a good Gmelin test. W. D. H.

Bile and Biliary Pigments. M. PIETTRE (*Compt. rend.*, 1908, **146**, 786—789).—The author has studied the absorption spectra of the bile of man, of the pig, of the dog, of the fowl, and of the haddock. These differ greatly, but all possess the two green bands $\lambda 572$ and $\lambda 535$, although with varying intensity. The latter seem analogous to the α ($\lambda 575$) and β ($\lambda 535$) bands of oxyhæmoglobin. Bilirubin has no specific spectrum; biliverdin, when first prepared, shows no absorption, but after exposure to the air the band $\lambda 638$ appears.

Besides these, chloroform extracts from bile a solid substance with a reddish-brown reflex, giving a deep orange solution and having a characteristic spectrum. The spectra observed in bile must be due to the superposition of the spectra of the latter two pigments, and their variations are explained by the differences in the proportions of the two pigments present. Diagrams are given of the spectra of the various species of bile studied. E. H.

Passage of Substances into the Human System by Osmosis. LOUIS KAHLENBERG (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxiv—xxvi; *J. Biol. Chem.*, 4).—Saturated boric acid solutions are absorbed through the skin, and boric acid appears in the urine within a few minutes. Lithium chloride diffuses through dead membranes and also through living mucous membranes more readily than boric acid, but it is not absorbed at all through the living skin. If the feet are soaked in citric acid the acidity of the urine rises, but if hydrochloric or sulphuric acids (decinormal) are employed, the urine becomes alkaline within a few minutes. W. D. H.

Peroxydase Reaction of Milk. JOSEPH H. KASTLE and MADISON B. PORCH (*J. Biol. Chem.*, 1908, **4**, 301—320).—In general, milk which has been boiled or pasteurised at, or above, 80° does not show the peroxydase reaction, whereas raw milk does. But there are exceptions to this rule, for all raw milk does not give the reaction as ordinarily carried out. The power of milk to induce the oxidation of phenolphthalin and other leuco-compounds by hydrogen peroxide is intensified by phenol, the three cresols, and β-naphthol. If these accelerators are employed, the test is a safe criterion between raw and cooked milk. Heating at 70° for one hour or at 75° for twenty minutes destroys the reaction; heating at 60° for twenty minutes (a method of pasteurisation recommended by Rosenau because it does not destroy the biological characters of milk) intensifies it. Cow's milk exhibits great variations in peroxydase activity, but as a rule the power of human milk is less, except during the colostral stage. W. D. H.

Bacterial Growth and Chemical Changes in Milk Kept at Low Temperatures. MARY E. PENNINGTON (*J. Biol. Chem.*, 1908, **4**, 353—394).—Bacteria in milk increase in numbers even at a little below 0°. Clean milk, containing 300 organisms per c.c., may in a few weeks contain some billions per c.c. The organisms which resist cold are principally those which form acid and act on protein. *B. formosus*, *B. solitarius*, and *B. Ravenel* are specially resistant. The caseinogen of milk is rapidly digested, caseoses, peptones, and amino-acids being formed; 50% of it may be changed into soluble compounds. The milk has a very high acid content; the formation of acid and digestion of caseinogen are far greater in cold storage than at room temperature. W. D. H.

Efficiency of Thymol and Refrigeration for the Preservation of Urine. PHILIP B. HAWK and HARRY S. GRINDLEY (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, ix—x; *J. Biol. Chem.*, **4**).—Urine to which a little thymol has been added and kept in cold storage (7—10°) shows no change in ammonia, creatinine, uric acid, urea, or total nitrogen after twenty-four hours. After ninety-six hours, the ammonia rises by 2·8% and the urea falls by 3·6%. W. D. H.

Mechanism of Salt Glycosuria. FRANK P. UNDERHILL and ISRAEL S. KLEINER (*J. Biol. Chem.*, 1908, **4**, 395—402. Compare Abstr., 1906, ii, 186, 243).—Renewed investigation has afforded no occasion to modify the views previously expressed by the authors regarding the mechanism of salt glycosuria. Under appropriate conditions in the rabbit, glycosuria due to renal permeability induced by sodium chloride injections can be inhibited by injections of calcium chloride. If calcium chloride is given, glycosuria fails to be evinced even when free sugar is injected in addition. W. D. H.

Excretion of Hexamethylenetetramine in Bile and Pancreatic Juice. S. J. Crowe (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxv—xxxvi; *J. Biol. Chem.*, 4).—After giving hexamethylenetetramine (urotropine) by the mouth to dogs, it was excreted in quantity both in bile and pancreatic juice. It also passes into the cerebro-spinal fluid. W. D. H.

Influence of Meat on the Dimethylaminobenzaldehyde Reaction of Urine. Christian A. Herter (*J. Biol. Chem.*, 1908, 4, 403—405).—The cherry-red coloration of the urine induced by an acid solution of Ehrlich's aldehyde is particularly strong in certain affections of the digestive tract. Bauer considers that the reaction depends on urobilinogen; it is also augmented by giving scatole, and indole-acetic acid in concentrated urine may also give the reaction. The exact mechanism of the reaction is far from clear, and the substances which produce it are probably numerous. It is always intensified both in dog's and human urine by the giving of meat, especially beef. Liebig's extract intensifies it somewhat. Feeding on blood has no effect, but the white flesh of fish, or ground beef thoroughly washed from pigments, does not induce the reaction.

W. D. H.

Indole-acetic Acid as the Chromogen of Urorosein. Christian A. Herter (*J. Biol. Chem.*, 1908, 4, 253—258).—A crystalline substance obtained from the urine of a patient suffering from a peculiar type of intestinal bacterial putrefaction was found to give reactions identical with those of indole-acetic acid. Both form scatole and carbon dioxide when heated, and give Nencki and Sieber's urorosein reaction. Bacteriologists who employ the nitrite reaction for indole should not confound indole-acetic acid with indole. The test for indole should never be made except in the distillate. W. D. H.

Hæmaphæic Reaction of Urines. Emile Dufau (*J. Pharm. Chim.*, 1908, [vi], 27, 333—336; *Bull. Soc. chim.*, 1908, [iv], 3, 460—462).—The reaction, formerly called hæmaphæic, which consists in the production of a reddish-brown colour when nitric acid is poured on urine, is due to the super-position of a yellow coloration, caused, at least in part, by urobilin, and of a red coloration, due to an unknown substance. G. B.

Effect of Ether Anæsthesia on Nitrogen Excretion. Philip B. Hawk (*J. Biol. Chem.*, 1908, 4, 321—352).—Ether anæsthesia in dogs increases the output of nitrogen during the twenty-four to forty-eight hours following the narcosis; the longer the duration of the anæsthesia the greater is this increase, but the actual amount varies greatly in different animals. Even in the same animal, the effect of anæsthesia is different at different times, in some cases even leading to a decrease in nitrogen excretion. Ether-narcosis has no effect on the fæces. The practical outcome of this is that in metabolism experiments, if ether anæsthesia is employed, the figures for nitrogen output are untrustworthy; check experiments on the influence of the anæsthesia alone are difficult, seeing how great is the variability of the result even in the same animal. W. D. H.

Fats and Lipoids of Malignant Hypernephromas. H. GIDEON WELLS (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxii; *J. Biol. Chem.*, 4).—These tumours show a high content of lecithin and cholesterol, and are probably of adrenal origin. W. D. H.

Chemo-therapeutic Trypanosome Studies. PAUL EHRLICH [in part with E. FRANKE] (*Chem. Zentr.*, 1908, i, 60—61; from *Berl. klin. Woch.*, 1907, **44**, Nr. 9—12).—In infectious diseases, a drug can only be of use if it is taken up more readily by the parasite than by the organism, that is, if it is more bacteriotropous, or aetiotropous (Hans Meyer), than organotropous. In general, bacteria are more resistant than the organism, but many protozoa take up dyes (such as methylene-blue) more readily, so that, for instance, trypan-red (from 1 mol. tetrazotised benzidinemonosulphonic acid and 2 mols. sodium naphthylamine-3 : 6-disulphonate) is active against trypanosomes. Some amino- and hydroxy-derivatives of trypan-red are more active than the original substance.

Triphenylmethane-dyes, derived from rosaniline by alkylation of the amino-groups, are, to trypanosomes, but slightly more aetiotropous than organotropous, and hence of no therapeutic value.

Substances derived from dyes, alkaloids, phenols, &c., by the introduction of acid groups, or of phenolic hydroxyl groups, are less toxic than the parent substances, and may be without action on trypanosomes.

The action of atoxyl (sodium p-aminophenylarsinate) on trypanosomes is also discussed. G. B.

Chemical and Physiological Properties of a Solution of Hydrochloric Acid and Sodium Chloride. AMOS W. PETERS (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxviii; *J. Biol. Chem.*, 4).—The lethal concentration of hydrochloric acid for protozoa is lowered by the addition of a concentration of sodium chloride, which, in itself, is harmless. Colorimetric experiments favour the hypothesis that this is due to the increased acidity of the mixture. W. H. D.

Action of Cæsium on the Normal and Fatty Heart. VITTORIO SCAFFIDI (*Chem. Zentr.*, 1908, i, 659; from *Arch. Farm. sperim.*, 1907, 6, 631—652).—The injection of a centi-normal solution of cæsium chloride into the muscles or under the skin increases the work of the heart in frogs and tortoises. As a similar action occurs with fatty hearts, it is considered that the favouring action is not entirely on the heart muscle, but also on the nervous system. W. D. H.

Influence of Potassium Cyanide on Nitrogen Excretion in Dogs. WILLIAM H. WELKER (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxxi; *J. Biol. Chem.*, 4).—Experiments on six dogs failed to show any alteration in the partition of nitrogen among the urinary constituents after subcutaneous dosage with potassium cyanide. W. D. H.

Physiological Action of Atropine and Allied Alkaloids. W. Webster (*Bio-Chem. J.*, 1908, **3**, 129—145).—In dogs, atropine, hyoscine, hyoscyamine, scopolamine, and daturine produce a fall of blood pressure. This is due to action on the heart substance, leading to a lessening of the cardiac output. Some degree of immunity is produced by repeated doses. In small doses, the respiration is made quicker and deeper; large doses paralyse it. The treatment of chloroform poisoning by atropine is not recommended. Adrenaline is better, although its utility is limited. W. D. H.

The Constipating Action of Morphine. Rudolf Magnus (*Pflüger's Archiv*, 1908, **122**, 210—250).—The experiments were performed on cats, dogs, and rabbits by Cannon's Röntgen ray method. The constipating action of morphine or of tincture of opium is almost entirely due to the delay produced in the stomach; the emptying of the stomach is delayed from three to 7—25 hours. The passage through the cardiac orifice of the stomach is also difficult. W. D. H.

Physiological Actions of Yohimbine. On the "Fly-catching Reflex." J. A. Gunn (*Quart. J. Exp. Physiol.*, 1908, **1**, 111—114). **On Medullated Nerve.** John Tait and J. A. Gunn (*ibid.*, 191—202).—A sub-lethal dose of yohimbine in frogs causes a hypersensitiveness of the centre involved in the snapping or fly-catching reflex, similar to that said to have been produced by the removal of the cerebrum. Its action on nerve resembles (with certain differences) that of anæsthetics, low temperature, and asphyxia. The abolition of conductivity is gradual, the refractory period is prolonged, and fatigue changes may be demonstrated; recovery from fatigue is, however, extremely rapid; a few seconds' rest abolishes it. W. D. H.

Toxicity of Silver Salts to Fishes. Luciano Pigorini (*Chem. Zentr.*, 1908, i, 56; from *Arch. Farm. sperim.*, 1907, **6**, 530—547).—Silver salts are toxic even at great dilution; the lethal doses of the fluoride, nitrate, and lactate are in the ratio 1 : 2 : 5. G. B.

Lead Poisoning and its Detection. P. Schmidt (*Arch. Hygiene*, 1907, **63**, 1—22).—When per million of red blood corpuscles there are more than one hundred containing basophil granules, chronic lead poisoning may be suspected; this affords valuable assistance in diagnosis. G. B.

Antitoxic Globulin. I. Edwin J. Banzhaf. **II.** E. J. Banzhaf and Robert H. Gibson (*Proc. Amer. Sci. Biol. Chem.*, 1907—8, xi—xii, xii—xiv; *J. Biol. Chem.*, **4**).—From a comparison of nitrated plasma and the anti-diphtheritic globulin solutions and their fractions, it appears that the antitoxic unit is not impaired by the elimination of albumins and other non-antitoxic proteins by the methods of salting-out and dialysis. The euglobulin is not increased relatively to the total globulin in horse's blood during immunisation. W. D. H.

Action of Various Chemical Reagents on the Virus of Rabies. Claudio Fermi (*Arch. Hygiene*, 1907, **63**, 315—330).—The virus is most susceptible to mercuric chloride, being destroyed in half-an-hour at a concentration of 1 : 130,000; next come silver salts, and then copper sulphate, mineral acids, and certain aniline dyes; phenol has only a feeble destructive action.

Cocaine and holocaine are without action on the virus, and can be used in therapeutic injections; the virus preserves its activity in glycerol for twenty days, but not much longer. G. B.

Toxolecithides. A. Minz (*Biochem. Zeitsch.*, 1908, **9**, 357—381).—The hæmolytic action which cobra poison exerts on blood corpuscles of certain species only in the presence of lecithin is inhibited by the presence of cholesterol, and investigations were undertaken to determine whether the cholesterol acts on the cobra poison (the prolecithide), the lecithin, or the combination of the two substances (the toxolecithide). One c.c. of a warm saturated solution of cholesterol was thrown into 9 c.c. of water. The suspension thus formed was treated in different experiments with the prolecithide, the lecithin, and the toxolecithide solutions. The mixtures were then filtered, and the hæmolytic actions investigated, in the case of the prolecithide, after addition of lecithin, and in the case of lecithin, after the addition of prolecithide. It was found that cholesterol removes from solution the lecithide, the prolecithide, and, to a minor degree, lecithin itself. The combination of prolecithide with cholesterol takes place in a very short time; after some hours, a further combination appears to take place; the reaction does not appear to be a simple one.

The neurotoxic action of cobra poison is not influenced by cholesterol; this substance may serve possibly, for this reason, for the separation of the neurotoxin from the hæmolysin. In the viper poison, the hæmorhagin is not influenced by cholesterol, whereas the hæmolysin combines; the former is, however, destroyed by hydrochloric acid, whereas the latter remains intact. These facts indicate the presence of two different components in the viper poison. S. B. S.

Chemistry of Vegetable Physiology and Agriculture.

Influence of Potassium Cyanide on the Respiration of Aspergillus niger, with Remarks on the Mechanism of the Action of Hydrocyanic Acid. G. Schroeder (*Chem. Zentr.*, 1908, i, 276; from *Jahrb. wiss. Bot.*, 1907, **44**, 409—481; *Naturw. Rundsch.*, 1907, **22**, 600—602).—The amount of carbon dioxide given off, and of oxygen taken up, by *Aspergillus* is diminished by potassium cyanide, but, if the poison does not act for too long a time, a complete return to normal respiration can take place. The action of potassium cyanide on respiration is a primary one, unlike that of ether. G. B.

Production of Ammonia by Bacteria. Berghaus (*Arch. Hygiene*, 1907, **64**, 1—32).—The saprophytic organisms examined produced much more ammonia than the pathogenic species. The increase of combined ammonia in the culture fluid is especially marked after the second week, and is due to a greater production of phosphoric, carbonic, and other acids, so that less ammonia escapes; about this time, most cultures begin to form a sediment which retains much ammonia.

The greatest production of ammonia observed was 17·4% of the available nitrogen. With killed cultures, a formation of ammonia by enzymes could be demonstrated. G. B.

The Decomposition and Formation of Lactic Acid by Micro-organisms. RICHARD MEISSNER (*Bied. Zentr.*, 1908, **37**, 215—216; from *Ber. k. Württemb. Weinbauversuchsanst.*, 1904).—Of the nine moulds examined, six readily consumed lactic acid, whilst the others did not; small amounts of volatile acids were formed during the process. Malic, succinic, tartaric, and citric acids can all be converted by some of the moulds, such as *Penicillium glaucum*, *Aspergillus niger*, and *Botrytis cinerea*, into lactic acid. E. J. R.

The Influence of Sterilisation on "Kalkstickstoff" Solutions. HUBERT KAPPEN (*Centr. Bakt. Par.*, 1908, ii, **20**, 704—715).—It is generally assumed in investigations on the decomposition of calcium cyanamide by bacteria that the preliminary sterilisation of the solution does not cause decomposition, or only a slight production of dicyanodiamide and calcium hydroxide, thus: $(CN\cdot NH)_2Ca + 2H_2O = C_2N_2(NH_2)_2 + Ca(OH)_2$; this decomposition is not supposed materially to effect the observed changes, since dicyanodiamide is not acted on by bacteria. The author controverts this view, and quotes as evidence of the complexity of the effect of heat the work of Hallwachs (*Annalen*, 1870, **153**, 293), showing that dicyanodiamide is decomposed by lime to form aminodicyanic acid, which again undergoes further changes. In no circumstances should "kalkstickstoff" solutions be sterilised by boiling; instead, the solid substance should be sterilised by dry heat, and the other constituents of the solution in the ordinary way. E. J. R.

The Decomposition of Calcium Cyanamide. HUBERT KAPPEN (*Bied. Zentr.*, 1908, **37**, 204—205; from *Fühling's Landw. Zeit.*, 1907, Heft 4).—Lohnis has stated that a preliminary heating of calcium cyanamide favours the action of bacteria, but the author is unable to confirm this. Dicyanamide and dicyanodiamide are only very slightly, if at all, attacked by the soil organisms; cyanamide, however, is readily decomposed, apparently more so than calcium cyanamide.

E. J. R.

On the Relation of Soil Bacteria to the Decomposition of Nitrogenous Organic Matter. CONRAD HOFFMANN (*Bied. Zentr.*, 1908, **37**, 219—220; from *23rd Annual Report Agric. Expt. Stat. Univ. Wisconsin*, 1906, 120).—An account of some preliminary experiments on the relation between the bacterial flora of the soil and the decomposition of various added nitrogenous compounds, especially dried blood, bran, bone-meal, and peat. The rate of decomposition is proportional to the number of bacteria present, and is therefore greater in soils containing large numbers of bacteria, such as peaty soils or loams, than in sandy soils, where the bacterial content is smaller. Formation of ammonia precedes nitrification, and distinct amounts of ammonia could always be detected in very fruitful soils. The dried blood and the bran were found to decompose more rapidly than the bone-meal or the peat. E. J. R.

Solvent Action of Soil Bacteria on the Insoluble Phosphates of Raw Bone-Meal and Natural Raw Rock Phosphate. WALTER G. SACKETT, ANDREW J. PATTEN, and CHARLES W. BROWN (*Centr. Bakt. Par.*, 1908, ii, **20**, 688—703).—The authors find that numerous organisms, which are not specific acid producers, are capable of dissolving a certain amount of the phosphates present in bone, and a smaller amount of those present in mineral phosphate. The greatest effect was seen when the organisms were inoculated with a culture solution made up of sodium chloride, potassium sulphate, and ferrous sulphate, with asparagine as the source of nitrogen and containing also bone meal. When peptone was used as the source of nitrogen, less phosphoric acid was found in the solution, and a still smaller quantity was dissolved when meat extract and peptone were used.

The organisms employed were *B. subtilis*, *B. mycoides*, *B. proteus vulgaris*, and *B. coli communis*, as well as several agar cultures from garden soil. In a few cases, it was found that the culture had consumed a greater amount of phosphate than it had dissolved.

The next series of experiments was made with acid-producing organisms, *B. acidi lacti* and "mother of vinegar" being tried. When inoculated respectively into milk and into fermented wort, these yielded liquids having, as might be expected, a strong solvent action on the phosphates.

The influence of the medium was next investigated. Organisms inoculated into an agar medium containing also magnesium and ammonium sulphates did not exert any solvent action on either calcium carbonate, di- or tri-calcium phosphate, bone-meal, or mineral phosphate. When sugar was added, the phosphates were attacked, as also when meat extract was added, but the action was then much reduced.

The results are regarded as preliminary, but they tend to show that the solvent action of micro-organisms on phosphates is not entirely the result of any secretion of acid specific to the organism, although it is greatly increased when such an acid is present. The carbon dioxide liberated by the organism appears to be a factor of importance.

E. J. R.

The Influence of Micro-organisms on the Utilisation of the Potassium in Leucite by Plants. SANTE DE GRAZIA and G. CAMIOLA (*Bied. Zentr.*, 1908, **37**, 207; from *Staz. sperim. agrar. ital.*, 1906, **39**, 829).—When leucite is introduced into a culture solution inoculated with certain moulds, it is attacked and dissolved. The amounts of potassium present in the various solutions at the end of the experiment were found to be: in the control, 0·0365; in a solution inoculated with *Aspergillus niger*, 0·0758, *Penicillium glaucum*, 0·0895, *P. brevic*, 0·0851, unknown mould, 0·0905. E. J. R.

Can Betaine be Regarded as a Source of Nitrogen for Yeast? Vladimir Staněk and Old. Miškovský (*Chem. Zentr.*, 1908, i, 146; from *Zeitsch. ges. Brauwesen*, 1907, **30**, 566—568).—Brewery and distillery yeasts cannot use betaine as a source of nitrogen when cultivated in inorganic nutrient solutions to which dextrose has been added. G. B.

Behaviour of Cultivated Varieties of Yeast in Composite Nutrient Solutions. Wilhelm Henneberg (*Chem. Zentr.*, 1908, i, 56—57; from *Woch. Brauerei*, 1907, **24**, 542—546, 575—579, 581—586, 596—601, 609—613, 618—620).—Seven varieties of yeast, from breweries and distilleries, were examined in solutions containing ammonium salts, asparagine, peptone, and a variety of salts. In acid solution, the cells die more rapidly than in neutral or in alkaline solution. The flocculation of top fermentation yeast is less than that of bottom fermentation yeast, but the difference is only relative. The latter kinds are less resistant. Addition of chalk, gypsum, sodium carbonate, or potassium phosphate increases the yield of alcohol; addition of calcium lactate hastens fermentation. The increase in acidity after all the sugar has been fermented increases with increase in the sugar concentration. Crystals of calcium oxalate were never observed. Morphological and other characteristics are also discussed. G. B.

The Production of Succinic Acid during Alcoholic Fermentation. Felix Ehrlich (*Bied. Zentr.*, 1908, **37**, 197; from *Zeitsch. Spiritusindustr.*, 1907, 327).—The author shows that under certain conditions glutamic acid is converted by fermentation into succinic acid; this happens when the yeast cells are insufficiently supplied with ammonia, and is apparently the result of the organisms attacking the acid for its nitrogen. The process is considered to be glutamic acid $\longrightarrow$ hydroxyglutaric acid $\longrightarrow$ formic acid and the semialdehyde of succinic acid $\longrightarrow$ succinic acid. The author suggests that the succinic acid formed during fermentation may arise in this way. E. J. R.

Anaerobic Respiration Without the Formation of Alcohol. II. S. Kostytscheff (*Ber. Deut. bot. Ges.*, 1908, **26a**, 167—177. Compare Abstr., 1907, ii, 571).—When a current of hydrogen is passed through the juice of *Agaricus campestris*, obtained by means of a Buchner press, considerable quantities of carbon dioxide are evolved, but not a trace of alcohol; with a current of air, more carbon dioxide is evolved (about twice as much). The pressed juice contained no unbroken cells; sterility was ensured by an addition of sodium fluoride, or, preferably, of quinine hydrochloride. The pressed juice does not reduce Fehling's solution, as alcohol is not even produced on the addition of dextrose to the juice; it follows that *Agaricus* does not contain zymase, and that, in this case, anaerobic respiration has no connexion with alcoholic fermentation. G. B.

The Respiratory Pigments of Plants. Wladimir Palladin (*Ber. Deut. bot. Ges.*, 1908, **26a**, 125—132; *Zeitsch. physiol. Chem.*, 1908, **55**, 207—222).—During the autolysis of germinating wheat, kept under chloroform water, a chromogen is formed, which oxidises at the surface of the liquid to a blackish-brown pigment, similar to that which gives black bread its colour, and to the black pigments formed in plant juices by laccase and by tyrosinase (compare Bertrand, Abstr., 1907, ii, 716).

It is now suggested that these pigments are formed from anaerobic precursors by oxidation with molecular oxygen during respiration, and, in order to bring out a physiological resemblance, the name *phytohaematin* is proposed for the members of this class of pigments. On this view, the process of respiration is primarily anaerobic, and results, for instance, in the production of alcohol and other substances, and of carbon dioxide and water. The absorption of oxygen is merely due to a secondary oxidation of some of the products of fission. G. B.

Chemical Processes Accompanying the Germination of Seeds. Francesco Scurti and A. Parrozzani (*Gazzetta*, 1908, **38**, i, 216—227. Compare Abstr., 1907, ii, 803).—The products of the proteolytic changes occurring in sunflower seeds digested at 30° with water containing acetic acid have been compared with the nitrogenous compounds found in the etiolated shoots of the same seeds. In both cases the following compounds were identified : xanthine, hypoxanthine, arginine, histidine, lysine, and choline, in addition to which the digested seeds contained a small proportion of tyrosine. The conclusion is drawn that in so far as the proteins are concerned, natural germination consists of an ordinary proteolysis quite analogous to that produced by the action of the isolated enzymes on the isolated proteins, and that such natural germination can be readily reproduced artificially. Further, in artificial germination, the alterations which the proteins undergo can be limited to simple hydrolytic actions, the partial or total disappearance of the products of proteolysis, such as occur in the latter stages of natural germination, being thus avoided.

In the authors' experiments, no asparagine was formed during the digestion of the sunflower seeds or during the initial period of their natural germination, although it made its appearance during the more advanced stages of the germinative process. This observation confirms Schulze's view that asparagine is not a direct product of the resolution of proteins, but is a secondary product formed by special transformations at the expense of the primary products. T. H. P.

Physiological Function of Potassium in Vegetable Organs. Julius Stoklasa (*Chem. Zentr.*, 1908, i, 746—747 ; from *Zeitsch. landw. Versuchswes. Oesterr.*, 1908, **11**, 52—61).—The chlorophyll of sugar beet and barley was found to contain 0·43 and 0·57% of K_2O. The amounts of sucrose and starch produced per 1 gram of potash are 25—27 and 23—25 grams respectively. N. H. J. M.

Vegetation of Odoriferous Plants. Successive Conditions of Plant Constituents during the Normal Development of a Perennial Plant. Roure-Bertrand Fils (*Chem. Zentr.*, 1908, i, 476—477 ; from *Wiss. industr. Ber. Roure-Bertrand Fils*, 1907, [ii], **6**, 3—14. Compare Abstr., 1907, ii, 905).—In perennial plants there is a migration of organic substances from the leaves to the flowering portions. With the approach of winter, however, there is also a migration to the roots. N. H. J. M.

Endo- and Ecto-invertase of the Date. A. E. Vinson (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxviii—xxx; *J. Biol. Chem.*, 4).—The invertase of the date cannot be extracted by solvents until the fruit ripens, although the green fruit tissues are very active when placed in a sugar solution. Tannin does not retard the action. The following theory is put forward. The endo-enzyme forms an insoluble combination with some constituent of the protoplasm without modifying its catalytic properties. This is independent of the life or death of the protoplasm. It is usually released on maturity, possibly by autolysis, but may be liberated by external, physical or chemical influences, which destroy the integrity of the cell. A similar view is advanced in relation to Buchner's zymase. W. D. H.

Chemical Examination of Micromeria Chamissonis (Yerba Buena). Frederick B. Power and Arthur H. Salway (*J. Amer. Chem. Soc.*, 1908, **30**, 251—265).—An account of the examination of the entire air-dried plant, *Micromeria Chamissonis* or Yerba Buena, which is indigenous to the Pacific Coast of the United States.

On distillation with steam, an essential oil was obtained in quantity amounting to 0·16% of the weight of the air-dried plant. This oil has a pale yellowish-brown colour, an aromatic mint-like odour, D^{20} 0·9244, and a_D 22°48′ in a 100 mm. tube.

The alcoholic extract of the plant was found to contain the following substances.

Xanthomicrol, $C_{15}H_{10}O_4(OH)_2$, m. p. 225°, a phenolic compound, which forms slender, lemon-yellow needles, and yields a *diacetyl* derivative, m. p. 116°. This substance is present to the extent of 0·02% of the air-dried plant.

An alcohol, *micromerol*, $C_{33}H_{51}O_3\cdot OH,2H_2O$, m. p. 277°, forms colourless needles, and has $[a]_D$ +57°; its *acetyl* derivative, m. p. 188°, has $[a]_D+47\cdot1°$, and the *methyl ether*, $C_{33}H_{51}O_3\cdot OMe,H_2O$, has m. p. 116—117°, or, when anhydrous, m. p. 167°. This substance forms about 0·25% of the air-dried plant.

An alcohol, *micromeritol*, $C_{30}H_{44}O_2(OH)_2,2H_2O$, m. p. 294—296°, crystallises in colourless needles, has $[a]_D+61\cdot4°$, and corresponds with about 0·05% of the air-dried plant; its *mono-* and *di-acetyl* derivatives have m. p. 255° and 204° respectively.

Among other substances present may be mentioned hentriacontane, m. p. 66—67°, about 0·05%; a phytosterol, $C_{27}H_{46}O,H_2O$, m. p. 135°; glycerides of palmitic, arachidic, and behenic acids; free formic, acetic, and butyric acids, and dextrose.

The plant does not exert any marked physiological activity.

E. G.

Root of Rheum Rhaponticum and Austrian Rhubarbs. Oswald Hesse (*J. pr. Chem.*, 1908, [ii], **77**, 321—352. Compare Abstr., 1900, i, 41; Gilson, *Bull. Acad. roy. med. Belg.*, 1903; Tschirch and Christafoletti, Abstr., 1905, ii, 851).—The roots of *Rheum*

Rhaponticum, 1904, and of *R. Austriacum*, 1905, 1906, 1907, have been investigated. Each was powdered, dried, extracted with ether and then with acetone, and from these extracts various fractions were obtained. Practically the same products were obtained from each root.

The products isolated were rhapontin, anhydrorhapontigenin, chrysophanic acid and its methyl ether (?), rhabarberon, chrysaron and its methyl ether, glycochrysaron, gallic acid, and rhapontic acid. The hydrolysis of certain fractions pointed to the presence of chrysophanin and glucogallin. Tschirch and Christofoletti's chrysopontin and chrysorhapontin were not obtained. It is probable that the former was impure rhabarberon and the latter chrysophanic acid. Rhapontin, $C_{21}H_{24}O_9$, may be obtained fairly pure by crystallisation from dilute acetic acid, or quite pure by the hydrolysis of its hexa-acetyl derivative. It forms colourless needles, begins to turn brown at 215°, and decomposes between 230° and 336°, according to the rapidity with which it is heated. It does not give a coloration with ferric chloride. It yields a *penta-acetyl* derivative, $C_{21}H_{19}O_9Ac_5$, m. p. 100° and $[\alpha]_D^{15} -11\cdot6°$, and a *hexa-acetyl* derivative, which is identical with Tschirch and Christafoletti's diacetylrhaponticin; it crystallises in brilliant colourless needles, and has m. p. 138° and $[\alpha]_D^{15} -30\cdot4°$.

Rhapontigenin crystallises when rhapontin is boiled with sixty times its weight of 5% sulphuric acid for about thirty-five minutes and the solution allowed to cool. The other product of hydrolysis is dextrose. Rhapontigenin crystallises from dilute methyl alcohol in colourless needles having the composition $C_{14}H_{11}O_3\cdot OMe,H_2O$, and not that stated by Tschirch and Christafoletti. It gives a green coloration with ferric chloride, and an intense red coloration with concentrated hydriodic acid. It has m. p. 188°, and yields a *triacetyl* derivative, $C_{14}H_8(OMe)(OAc)_3$, m. p. 112°, which yields unaltered rhapontigenin when hydrolysed with calcium hydroxide solution.

In one experiment, *anhydrorhapontigenin*, $C_{15}H_{12}O_3$, was obtained by the action of acetic anhydride and rhapontigenin at 89—90°. It crystallises from glacial acetic acid in glistening yellow plates, m. p. 203°.

iso*Rhapontigenin*, $C_{14}H_{11}O_3\cdot OMe$, crystallises from dilute acetic acid, and when moist turns brown on exposure to the air; it is not soluble in either sodium hydroxide or carbonate solutions.

Glycochrysaron, $C_{21}H_{20}O_{10},H_2O$, crystallises from alcohol in small, yellow, nodular masses, dissolving in sodium hydroxide to a purple solution. It is hydrolysed by dilute aqueous alcoholic sulphuric acid to dextrose and *chrysaron*, $C_{15}H_{10}O_5$. This latter crystallises in glistening plates, m. p. 165°, and appears to be accompanied by a small amount of a methyl ether. When reduced with hydriodic acid, it yields *chrysaranthranol*, $C_{15}H_{12}O_4$, m. p. 225° (decomp.), which crystallises from alcohol in small, yellow plates.

Chrysophanic acid has m. p. 195—196°, and is accompanied by chrysaron, from which it can be freed by conversion into its acetyl derivative and crystallisation from ethyl alcohol. *Triacetylchrysaron*, $C_{15}H_7O_5Ac_3$, forms pale yellow plates or prisms, m. p. 165°, and is also accompanied by a small amount of a methyl ester.

The last acetone fractions yield a resin from which *rhapontic acid*, $C_{20}H_{18}O_7$ or $C_{17}H_{16}O_6$, has been isolated as a brown powder soluble in alkalis to red solutions. It begins to decompose at 190°, and is completely fused at 230°. J. J. S.

Power of Sodium Nitrate and Calcium Carbonate to decrease Toxicity in Conjunction with Plants Growing in Solution Cultures. Oswald Schreiner and Howard S. Reed (*J. Amer. Chem. Soc.*, 1908, **30**, 85—97).—Seedlings of wheat were kept for twelve to fourteen days in solutions containing from 1 to 1000 parts per million of different organic compounds. The solutions were then made up to the original volume and used a second time with a fresh set of seedlings. The smallest amounts of each substance (in parts per million) which caused injury to the seedlings were as follows:

	Arbutin.	Coumarin.	Cinnamic acid.	Sodium cinnamate.	Vanillin.
1st crop	25	1	25	100	50
2nd crop............	500	100	25	100	500

Whilst cinnamic acid and its sodium salt retained their original toxic properties, the toxicity of arbutin, coumarin, and vanillin was greatly reduced by contact with the roots of the first set of seedlings. The change is attributed mainly to alterations caused by the action of the roots and to a less extent to loss due to direct absorption by the root. Addition of pyrogallol was found to reduce the toxicity of coumarin; inorganic compounds, such as sodium nitrate and calcium carbonate, were found to be distinctly beneficial in decreasing the toxic effect of organic substances. N. H. J. M.

Relation between the Effects of Liming and of Nutrient Solutions containing different Amounts of Acid on the Growth of Certain Cereals. Burt L. Hartwell and F. R. Pember (20*th Ann. Rep. Rhode Island Agric. Exper. Stat.*, 1906—7, 358—380).—The results of previous field experiments showed that, whilst rye was very slightly affected by liming, the yield of barley grown under similar conditions was increased 100—200% by the application of lime. Water culture experiments were therefore made to ascertain whether the plants chiefly benefited by liming are also more susceptible to injury by acids. It was found that barley seedlings are not more injured than rye.

Alkalinity which is insufficient to precipitate ordinary nutrient solutions has no material effect on the growth of seedlings of wheat, rye, barley, and oats, and the same seedlings are hardly affected by acidity equal to $N/5000$. Acidity equivalent to $N/2500$, $N/1700$, and $N/1250$ decreased the production of green substance about 20, 40, and 60% respectively. N. H. J. M.

Effect of Commercial Sodium Nitrate on Rye. Sante de Grazia (*Bied. Zentr.*, 1908, **37**, 205—206; from *Staz. sperim. agrar. ital.*, 1906, **39**, 529).—In a number of experiments both in 1903 and 1905, the author found that commercial sodium nitrate gave a slightly higher yield both in grain and straw than the pure salt. The commercial substance contained small quantities of potassium, calcium, magnesium, and sulphuric acid, any, or all, of which might contribute to this result. E. J. R.

The Effect of the New Nitrogenous Fertilisers on Hemp. VRAT. STÖHR (*Bied. Zentr.*, 1908, **37**, 229—233; from *Haspodar Moravsky*, 1907, **9**, No. 20).—Trials were made on a loamy soil in large wooden vessels, each receiving 3 grams of nitrogen in addition to potash and phosphoric acid. The fertilisers tested were "nitrate of lime" (Notodden), Frank's Kalkstickstoff, and Polzenius's Stickstoffkalk, sodium nitrate, and ammonium sulphate.

"Nitrate of lime" gave substantially the same results as sodium nitrate and ammonium sulphate, the other two fertilisers being less effective. E. J. R.

Comparative Investigation of the Results of Chemical Soil Analyses and of Cultivation Experiments. K. OPITZ (*Chem. Zentr.*, 1908, i, 285; from *Landw. Jahrb.*, 1907, **36**, 909—932).—Of soils examined (at Breslau), only 10—11% contained enough phosphoric acid, and 50—55% enough soluble potassium salts. A content of 0·1% P_2O_5, soluble in 10% hydrochloric acid, may, in general, be considered sufficient. Light soils with more than 0·1% of soluble potassium salts have almost certainly enough, and heavy soils with less than 0·1% almost certainly too little. A content of 0·25% of soluble calcium salts is enough in all cases, although a much smaller amount may suffice in some. G. B.

Studies on Humus Formation. SHIGEHIRO SUZUKI (*Bul. Coll. Agric. Tokio*, 1907, **7**, 419—493. Compare this vol., ii, 127).—Experiments on humification are described in which test-tubes and dishes containing clay soil with 10% of various organic substances were kept for ninety days at about 30°. Blackening occurred throughout in the case of soil containing tannin, and to a large extent in soils containing egg-albumin and starch with meat extract. Dextrose with meat extract, crude araban with meat extract, and straw blackened slightly, whilst xylan with meat extract blackened only in the lower portion of the tube. Crude araban, xylan, starch, and dextrose did not blacken in absence of meat extract, whilst cellulose and sawdust failed to blacken both with and without meat extract. N. H. J. M.

Effect of Carbon Disulphide on Soils and Plants. M. EGOROW (*J. Landw.*, 1908, **9**, 91—95).—Carbon disulphide may act injuriously on soils by dissolving the resinous and fatty substances present and then depositing them on the surfaces of the particles of soil. In this manner, the power of retaining water is diminished, and the capillary rise of water rendered slower.

Both carbon disulphide and ether (0·03—0·06 per litre) were found to stimulate the growth of etiolated seedlings of *Helianthus annuus* and *Cucurbita Pepo.* N. H. J. M.

Isolation and Toxic Properties of an Organic Soil Constituent. OSWALD SCHREINER and EDMUND C. SHOREY (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxvi; *J. Biol. Chem.*, **4**).—A crystalline organic compound was separated from several unproductive soils. It melts at 98—99°, and has the composition of dihydroxystearic acid. It was found to be harmful to plant growth. W. D. H.

Toxic Substances Arising during Plant Metabolism. Oswald Schreiner and M. X. Sullivan (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, xxvi—xxvii; *J. Biol. Chem.*, 4).—From wheat-sick soil there was obtained by steam distillation a crystalline substance which is toxic to wheat. From cowpea-sick soil, another crystalline substance was obtained, which was toxic to cowpea, but not to wheat. If the extracts of the soils are shaken with carbon-black, the deleterious substances are removed. W. D. H.

Fertilising Value of Snow. Frank T. Shutt (*Trans. Roy. Soc. Canada*, 1908, [iii], 1, 35—38).—Determinations of nitrogen were made in twelve samples of snow collected just outside Ottawa from February 21 to May 4, 1908, the first sample representing the surface 1·5 inch of snow accumulated since November, 1907, whilst all subsequent samples were freshly-fallen snow. The amounts of nitrogen per million of snow are as follows:

	Nitrogen per million			
	As ammonia.	As nitrates and nitrites.	Albuminoid ammonia.	Total.
Arithmetical means	0·256	0·163	0·052	0·471
Minimum	0·082	0·024	0·033	0·180
Maximum	0·589	0·390	0·078	0·972

The percentages of nitrogen as ammonia and as nitrates in the total (excluding albuminoid ammonia) were 61·1 and 38·9 respectively. The snowfall during the winter 1907—8 amounted to 85·5 inches, or about one inch reckoned as rain; the total nitrogen, per acre, in the snow would therefore be about 1 lb. N. H. J. M.

Manurial Experiments on Pasture Land. Erik Solberg (*Bied. Zentr.*, 1908, 37, 157—161; from *Beretning Statens kemiske Kontrolstation i Trondhjem*, 1903—1907).—A number of manurial trials on pasture land are recorded, and it is shown that in most cases a complete manure is most profitable. Nitrates especially were found to be valuable; even soils rich in nitrogen responded freely, so that the nitrogen content of the soil was no guide to its behaviour with nitrogenous manure. On the other hand, there was a relation between the amount of phosphoric acid or of potassium found by analysis (presumably by the Norwegian method) and the effect of phosphatic or potassic manuring, a soil poor in either of these constituents proving distinctly responsive when the deficiency was made up.

E. J. R.

Swedish Manurial Trials. P. Bolin (*Bied. Zentr.*, 1908, 37, 161—168; from *Bihang k. landtbruks-akad. Stockholm*, 1907).—Oats were found to respond best to a mixture of superphosphate and sodium nitrate unless the soil was rich in humus, when superphosphate only was required; potatoes, however, responded to a complete manure even on rich soils. Beets also required a complete manure, but, when varying amounts of potash were used, the gain in crop due to the extra increments of potash was less than was expected. The effect of manures on grass land depended on the nature of the herbage; where grasses predominated, sodium nitrate proved most effective and potash least; where there was a large amount of clover, superphosphate gave the largest increase.

Experiments with "nitrate of lime" (the basic calcium nitrate produced in Norway) show that it was fully as useful as sodium nitrate; cyanamide also proved to be as good as sulphate of ammonia.

E. J. R.

Manurial Trials with Precipitated Calcium Phosphate. Henrik G. Sôderbaum (*Bied. Zentr.*, 1908, **37**, 155—157; from *Meddelanden k. landtbruks-akad. Stockholm*, 1907, 1—10).—The author investigates the effect on barley of precipitated calcium phosphate obtained from Norwegian apatite by Palmoer's process. This process consists in electrolysing a solution of sodium chlorate or perchlorate, and allowing the chloric acid or perchloric acid from the anode to act on the mineral phosphate. By systematically arranging the extraction, a saturated solution is finally obtained; this is then mixed with the alkaline liquor from the cathode until the acid is neutralised, the whole being shaken meanwhile. A fine, granular precipitate is obtained, quite white, and almost free from foreign matter. Its composition depends on the temperature of precipitation; at the ordinary temperature, dicalcium phosphate, $CaHPO_4$, is chiefly produced; at 50°, however, some tricalcium phosphate is thrown down. The former, being more soluble, is of more immediate use to the plant, and has substantially the same effect as superphosphate. The material precipitated at 50°, on the other hand, is only about half as useful as superphosphate, particularly when applied in small dressings.

E. J. R.

Relation between the Increased Yield due to Phosphatic Manure and the Amount of Phosphoric Acid in the Soil. Ferdinand Pilz (*Zeitsch. landw. Versuchswes. Oesterr.*, 1908, **11**, 36—51).—Field experiments with barley showed that the increase in yield resulting from manuring with superphosphate increased with the percentage of nitrogen in the soil. Similar indications were obtained by grouping the results according to the amount of potassium in the soil; in the case of potassium, however, the relationship is less marked. When soils containing simultaneously more than 0·2% of nitrogen, phosphoric acid, and potash are compared with soil containing less than 0·2%, the crop results show that application of phosphoric acid has more effect on the former than on the latter. N. H. J. M.

Effect of the Addition of Sodium to Deficient Amounts of Potassium on the Growth of Plants in both Water and Sand Cultures. Burt L. Hartwell, H. J. Wheeler, and F. R. Pember (*20th Ann. Rep. Rhode Island Agric. Exper. Stat.*, 1906—7, 299—357).—The results of water-culture experiments with wheat indicated that the presence of sodium does not result in increased growth in presence of an optimum amount of potassium, but may give an increase of 10% when there is a deficiency of potassium sufficient to cause a depression of about 30% in the weight of produce. The beneficial effect of sodium cannot be due to increased osmotic pressure in the solution, as no increase was caused by extra amounts of calcium, magnesium, phosphorus, or nitrogen.

Less potassium was taken up by seedlings when the potassium was supplemented by sodium.

Sand-culture experiments gave similar results. N. H. J. M.

The Application of Leucite as Manure. E. MONACO (*Bied. Zentr.*, 1908, **37**, 206; from *Staz. sperim. agrar. ital.*, 1906, **39**, 340).—The mineral used contained 8·46% of potash, and was found to be sufficiently soluble in water and various other solvents to justify its use as manure. E. J. R.

Analytical Chemistry.

Rapid Measuring Vessel and Rapid Pipette. FRIEDRICH SCHUBERT (*Chem. Zentr.*, 1908, i, 321; from *Oesterr.-ung. Zeitsch. Zuckerind. Landw.*, 1907, **36**, 629—631).—A new form of self-filling measure and self-filling pipette is described, the rapid action of which is due to the replacement of the usual small hole through the tap by a groove of considerable size. J. V. E.

Modification of the Soxhlet Extractor. HORATIO C. WOOD (*Amer. J. Pharm.*, 1908, **80**, 106).—The body of the apparatus consists of a wide glass tube, the lower end of which is connected by means of a tightly fitting cork with a siphon-shaped tube, and the upper end is closed with a cork into which is fitted a tube connected with a reflux apparatus. The latter tube carries a side tube which is bent downwards and into the flask containing the solvent. When the contents of the flask boil, the vapours pass up the tube into the reflux apparatus, are condensed, and fall on to the substance to be extracted, previously placed in the body of the apparatus, and the extract flows back into the flask through the siphon. W. P. S.

Apparatus for Estimations Involving Distillation. GILBERT T. MORGAN and TAYLOR COOK (*Analyst*, 1908, **33**, 117—121).—The apparatus is similar to that described previously by Morgan (Trans., 1904, 1001), but the stopper of the distillation flask is modified. The stem of a tapped funnel is fused into the hollow stopper, and a side tube allows a gaseous reagent to be admitted to the flask. The delivery tube of the flask fits tightly by means of a ground-in joint into the top of a vertical condenser, the lower end of the latter being elongated so that it may dip into an absorbent liquid contained in the receiver. A duplicate flask of smaller capacity is also provided; the neck of this flask is of sufficient diameter to fit the stopper of the larger flask, but is somewhat longer than that of the latter, in order that the tube of the stopper may reach nearly to the bottom of the vessel in each case. W. P. S.

Preparation of Alcoholic Potassium Hydroxide Solution and Apparatus for Storing the Same. A. Scholl (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 343—344).—In order to prevent the formation of a brown colour in alcoholic potassium hydroxide solution when kept for some time, the author recommends that the solution be prepared by crushing the potassium hydroxide (in the form of sticks) in an iron mortar; the powder is then transferred to a flask, and sufficient alcohol is added to produce a solution which shall not contain more than 56 grams of the alkali per litre. The solution should not be heated. After filtration, the solution is placed in a bottle, closed by a cork through which passes a tube reaching to the bottom of the bottle. The upper end of the tube ends in a measuring device for delivering a definite volume of the solution. This device consists of two bulbs; on forcing air into the bottle by means of an indiarubber bulb, the solution rises up the tube, fills the lower bulb, and any excess is then allowed to run back from the upper bulb into the bottle, a side tube on the indiarubber pipe allowing the air to escape. A small soda-lime tube is fitted on the tube between the indiarubber bulb and the bottle, and a second one is fixed to the upper bulb. A glass rod passing through the two bulbs acts as a delivery valve for the solution in the lower bulb. W. P. S.

Gas Analyses. Georges de Voldere and Willem de Smet (*Chem. Weekblad*, 1908, **5**, 171—175).—A mathematical paper. The views on the combustion of gases entertained by Anema and van Deventer (this vol., ii, 221), although rigidly correct, do not apply to all kinds of gaseous mixtures.

The authors refer to their own publications (*Rev. gen. chim. pure appl.*, 1906, **9**, 365; 1907, **10**, 233), where the matter is fully discussed. L. de K.

Analysis of High Percentage Gases. Hartwig Franzen (*Zeitsch. anorg. Chem.*, 1908, **57**, 395—397).—A simple arrangement is described by means of which a gas can be absorbed from a mixture containing much non-absorbable gas. The apparatus containing the mixed gases is connected through a wash-bottle with a cylindrical absorption vessel provided with a stop-cock at each end. The absorbing solution is sucked up into the absorption vessel, and when exhausted can be replaced by a fresh supply. When absorption of the gas in question is complete, a portion of the residue can readily be transferred to a Hempel burette or other apparatus for further investigation. G. S.

Estimation of Hydrogen in Technical Gas Analysis. Enrique Hauser (*Anal. Fis. Quim.*, 1908, **6**, 77—89).—A discussion of the degree of accuracy of different methods now in use. Slight modifications in the construction and manipulation of Hempel's apparatus for the absorption of hydrogen by palladium are described.

W. A. D.

Estimation of Small Amounts of Fluorine. George Steiger (*J. Amer. Chem. Soc.*, 1908, 30, 219—225).—The powdered rock is fused with four to five times its weight of sodium potassium carbonate, the fused mass is extracted with water, and digested with ammonium carbonate. The filtrate, which is now practically free from alumina and silica, is carefully neutralised with dilute sulphuric acid, well shaken, and then fully acidified. To the solution is added titanium sulphate solution and some hydrogen peroxide, and the coloration formed is compared in a suitable colorimeter with a solution containing the same amount of titanium and hydrogen peroxide. In presence of fluorine, a perceptible fading of the colour is noticed, but this bleaching is not directly proportional to the amount of fluorine. Reference is therefore made to a curve (see original paper).

L. de K.

Estimation of the Total Sulphur in Urine. Emil Österberg and Charles G. L. Wolf (*Biochem. Zeitsch.*, 1908, 9, 307—309).—The method suggested by Schulz (this vol., ii, 129), namely, the oxidation of organic matter with fuming nitric acid and precipitation of sulphates with barium chloride, gives results which are too low.

S. B. S.

Estimation of Tellurium. Victor Lenher and A. W. Homberger (*J. Amer. Chem. Soc.*, 1908, 30, 387—391).—The authors have finally adopted the following process: The tellurium (about 0·2 gram), being present as a derivative of the dioxide or as a tellurate, is dissolved in hydrochloric acid of 10% strength and heated to boiling. Fifteen c.c. of strong sulphurous acid are added, then 10 c.c. of a 15% solution of hydrazine hydrochloride, and then again 25 c.c. of sulphurous acid. The boiling is continued until the precipitated tellurium has properly settled. It is then collected on a Gooch crucible, washed with hot water, then with alcohol, and finally dried at 105°.

L. de K.

Estimation of Total Nitrogen, including Nitrates, in Presence of Chlorides. W. D. Richardson (*J. Amer. Chem. Soc.*, 1908, 30, 421—422).—The nitric nitrogen is estimated by the Schloessing-Wagner method. In a second portion of the sample, the nitrogen is estimated by the Kjeldahl-Gunning method, after destroying the nitrates by boiling with dilute sulphuric acid and 10 c.c. of saturated ferrous chloride.

The sum of the two estimations equals the total nitrogen.

L. de K.

Spiro's and Folin's Methods for Urea and Ammonia Estimations. Paul E. Howe and Philip B. Hawk (*Proc. Amer. Soc. Biol. Chem.*, 1907—8, x—xi; *J. Biol. Soc.*, 4).—Spiro's method gives a slightly higher value for ammonia than Folin's, but a considerably higher value for urea; the excess in the latter case is due to nitrogen arising from creatinine and hippuric acid. W. D. H.

Variations in the Composition of Ammonium Phosphomolybdate. Application to the Estimation of Phosphorus in Iron, Cast-Iron, and Steel. Gabriel Chesneau (*Compt. rend.*, 1908, **146**, 758—761).—As the discrepancies between the percentages of phosphorus in ammonium phosphomolybdate found by various authors are too large to be due entirely to the causes of error described previously (Abstr., 1907, ii, 985), the author has precipitated various weights of disodium hydrogen phosphate with solutions of ammonium molybdate containing (1) 50 grams of ammonium molybdate and 500 c.c. of nitric acid (D 1·2) per litre, and (2) the same as (1) together with 5 grams of ammonium nitrate, and finds that the composition of the precipitate varies considerably with the conditions. In each experiment, 50 c.c. of the reagent were used, and the mixture was heated at 45° for 2·5 hours. Using the first reagent, the proportion of phosphorus in the precipitate increases from 1·69% with phosphate containing 6·648 mg. of phosphorus to 2·25% with 0·277 mg. of phosphorus. In the presence of ammonium nitrate, the corresponding variation is from 1·62% to 1·28%. This variation is closely correlated with the crystalline form of the precipitates. With the first reagent, the precipitates are composed of very small, yellow crystals of the cubical system, the yellow colour becoming brighter as the content of the phosphorus increases. In the presence of the nitrate, the precipitates are not composed of crystals properly so-called, but of "crystallites" in the form of tripods resembling three edges of a cube. The crystallites have rounded edges, and apparently are composed of a large number of small grains. Like the cubical crystals, they have no action on polarised light; their yellow colour is fainter than that of the crystals, and diminishes with the proportion of phosphorus. When the latter is very small, the crystallites are ill-defined, and birefringent needles of ammonium tetramolybdate make their appearance.

The conclusion is drawn that the precipitates are mixtures (heterogeneous in the presence, homogeneous in the absence, of ammonium nitrate) of a definite compound with quantities of molybdic acid (or tetramolybdate) varying with the concentration.

Such variations readily explain the discrepancies between the percentages of phosphorus in ammonium phosphomolybdate observed by different authors.

The precipitates formed in ferric solutions exhibit precisely similar variations in composition.

The author recommends the following precautions in estimating phosphorus in iron: (1) For 1 gram of metal, 5 grams of ammonium nitrate, and 50 c.c. of a reagent containing 50 grams of crystallised ammonium molybdate, 50 c.c. of concentrated ammonia and 500 c.c. of nitric acid (D 1·2) per litre. (2) The first precipitation should occupy 1·5 hours at 65—70°. (3) The same quantity of ammonia should invariably be used to redissolve the precipitate, a further 15 c.c. of the molybdate reagent should be added after acidification, the second precipitation should occupy two hours at 40°, and the precipitate should be washed with pure water. Under these conditions, the precipitate has a constant composition independent of the concentration of the phosphorus, and, after drying at 105°, contains 1·60% of phosphorus. If the dry precipitate is dissolved in ammonia, the solution evaporated to dryness, and the residue heated at 400—450°, a blue pyromolybdate containing 1·69% of phosphorus is formed.

E. H.

Loss of Phosphoric Acid in the Incineration of Cereals. Sherman Leavitt and J. A. Leclerc (*J. Amer. Chem. Soc.*, 1908, **30**, 391—394).—The heat from a blast lamp or a muffle is not sufficiently strong to affect sensibly the total ash, but is nevertheless too high when an accurate estimation of the phosphoric acid is required.

The loss by volatilisation may be lessened by the addition of calcium acetate. L. de K.

[Volumetric Estimation of] Phosphoric Acid. Virgil Coblentz and Otto B. May (*Amer. J. Pharm.*, 1908, **80**, 151—154).—The iodometric method proposed by A. Christensen was found to give trustworthy results in the estimation of phosphoric acid, the analyses recorded being carried out on a phosphoric acid solution which complied with the requirements of the U.S. Pharmacopœia. Five c.c. of a 5% solution of the sample (containing about 85% of H_3PO_4) are introduced into a stoppered 150 c.c. flask, 2 grams of potassium iodide, 5 c.c. of saturated potassium bromate, and 30 c.c. of water are added, and the flask is closed securely. The reaction proceeds according to the equation: $6H_3PO_4 + 6KI + KBrO_3 = 6KH_2PO_4 + 3I_2 + KBr + 3H_2O$, and is completed at the ordinary temperature in from 2·5 to 3 hours. The liberated iodine is then titrated in the usual way. W. P. S.

Estimation of Phosphoric Acid by the Uranium Process. Fernand Repiton (*Chem. Zentr.*, 1908, 1, 295; from *Mon. Sci.*, 1907, [iv], **21**, 815—816. Compare this vol., ii, 320).—In applying the uranium process to calcium phosphates, it is advisable to check the standard uranium solution with a solution of calcium phosphate containing an accurately known amount of phosphoric oxide. In order to estimate the latter, the author recommends the iron method, in which the phosphoric acid is precipitated by a solution of ferric nitrate of known strength and the excess of the iron precipitated by boiling with ammonium acetate. The weight of the joint precipitate less the amount of iron oxide employed = P_2O_5. L. de K.

A Method of Soil Analysis for Investigations in Plant Physiology. E. A. Mitscherlich (*Bied. Zentr.*, 1908, **37**, 145—148; from *Landw. Jahrb.*, 1907, **36**, 309).—The author uses a solution of carbon dioxide as a solvent in soil analysis, as has often been done before, because it may be supposed to have approximately the same effect on the soil constituents as the natural soil solution. Some preliminary investigations were made to determine the best quantities to use, and the most suitable temperature of working; finally, a method was evolved which, when applied to certain soils manured with known quantities of kainite, superphosphate, and sodium nitrate, discriminated between the added substances and the less soluble soil constituents. No experiments were made on soils of known cropping power, and it still remains to be seen whether the results yielded by this method can be correlated with crop results. E. J. R.

Estimation of Arsenic in Lead-Antimony Alloys. GEORGE M. HOWARD (*J. Amer. Chem. Soc.*, 1908, **30**, 378—380).—The method is based on the insolubility of arsenious sulphide in concentrated hydrochloric acid. 0·5—2 Grams of the alloy are dissolved in 60—70 c.c. of strong hydrochloric acid with the aid of a few drops of nitric acid. When all is dissolved, a current of hydrogen sulphide is passed for about fifteen minutes, and the excess is then removed by a current of air. After adding a little tartaric acid and an equal volume of water, the solution is filtered and titrated for antimony in the usual way, with standard iodine in presence of a slight excess of sodium hydrogen carbonate. The precipitate, consisting of arsenious sulphide and sulphur, is dissolved in 20 c.c. of water with the aid of about 5 drops of 20% sodium hydroxide, and 20 c.c. of 3% hydrogen peroxide are added. After boiling down to 20 c.c., 0·1 gram of potassium iodide is added, and also 20 c.c. of hydrochloric acid. After five minutes, the iodine liberated (which represents the arsenic) is titrated with standard thiosulphate, using starch as indicator. L. DE K.

Iodometric Estimation of Arsenious Acid. EDWARD W. WASHBURN (*J. Amer. Chem. Soc.*, 1908, **30**, 31—46).—See this vol., ii, 363.

Detection of Boric Acid in Foods. CARL MANNICH and H. PRIESS (*Chem. Zeit.*, 1908, **32**, 314—315).—Five grams of the substance, such as meat, are rubbed in a mortar with 0·25 c.c. of 20% sulphuric acid, and then repeatedly with small quantities of 90% alcohol until the total filtrate measures 50 c.c. Twenty c.c. of this are then mixed with 0·5 c.c. of 15% sodium hydroxide, and, after evaporating to dryness, the residue is burnt to ash. This is moistened with 2 c.c. of sulphuric acid, and then introduced into Beckmann's spectrum lamp (Abstr., 1907, ii, 209). After ascertaining that the flame is colourless, the basin is rinsed with 4 c.c. of methyl alcohol, which is then also introduced into the apparatus, when a persistent green colour of the flame will show the presence of boric acid. L. DE K.

Apparatus for the Estimation of Carbide in Steel and Iron. G. MARS (*Chem. Zentr.*, 1908, i, 165; from *Zeitsch. Chem. Apparatenkunde*, 1907, **2**, 606—607).—A flask, holding about 1 litre, is fitted at the top with a funnel and stopcock. The funnel is drawn out at the top, so that it may be connected with a gas-generating apparatus by means of a rubber tube. The bottom of the flask is fitted with a stopcock having an additional piece, to which is sealed a filtering tube. The apparatus allows of the separation, filtration, washing, and drying of any insoluble, but oxidisable, substance with exclusion of air.

Working on 1 gram of iron, and using dilute hydrochloric or sulphuric acid (1 : 10), an estimation of carbide will take from two to four hours.
L. DE K.

New Gravimetric Processes. [Estimation of Carbon Dioxide; Nitric Acid; Arsenic.] PAUL JANNASCH (*Chem. Zentr.*, 1908, i, 410—411; from *Verh. Naturhist-Med. Vereins, Heidelberg*, 1907, 9, 74—86).—*Indirect Estimation of Carbon Dioxide by Fusion with Sodium Pyrotungstate.*—7·5 Grams of sodium tungstate are fused with 2·5 grams of tungstic acid, and, after cooling in a desiccator, the mass is weighed. A weighed quantity of the carbonate is sprinkled over the surface, and the mass is again fused, when the loss in weight represents the carbon dioxide.

Indirect Estimation of Nitric Acid in Nitrates.—This is effected in the same way as with carbonates.

Estimation of Carbon Dioxide by Heating with Sulphuric Acid and Collecting the Gas in Soda-Lime Tubes.—0·5 Gram of the carbonate is placed in a 200 c.c. generating flask, and treated with 20 c.c. of strong sulphuric acid, afterwards heating at 85—90°. A current of dried, purified air is then passed through the apparatus to expel the carbon dioxide completely.

[With E. HEIMANN.]—Arsenic acid may be separated from iron by heating with hydrochloric acid with addition of hydrazine sulphate. The metallic mixture is evaporated with nitric acid, and the dry residue dissolved in 200 c.c. of hydrochloric acid and 5 grams of hydrazine sulphate. After connecting the flask with the usual absorption tubes filled with water, a rapid stream of hydrogen chloride is passed for fifteen minutes, and 125—200 c.c. of the solution are then distilled off, which operation should occupy from three to five hours. The distillate contains all the arsenic.
L. DE K.

Detection of Small Quantities of Helium in Minerals. FRED. BORDAS (*Compt. rend.*, 1908, **146**, 628—630).—The minerals to be examined for helium or other gases are heated in a quartz tube which is connected by suitable taps with a Plücker tube and a Dewar charcoal absorption tube. The gas evolved is examined spectroscopically, and is then exposed to the action of the cooled charcoal. These operations are several times repeated; the fact that helium is much less quickly absorbed than other gases allows of its detection by this method even when present in very minute quantities.
H. M. D.

Estimation of Potassium by the Platinichloride Method. HENRI J. F. DE VRIES (*Chem. Weekblad*, 1908, **5**, 176—184. Compare Abstr., 1907, ii, 504, 719).—The paper is devoted chiefly to the analysis of samples containing much potassium (or other) sulphate. This sulphate should be converted into chloride by precipitation with the merest excess of barium chloride, but, on account of the slight solubility of barium sulphate in liquids containing free hydrochloric acid, only a few drops of this should be present in 50 c.c. of the solution. If excess of barium chloride cannot be avoided, 80% alcohol should be used to dissolve the excess of platinic chloride.
L. DE K.

Estimation of Sodium and Potassium in Silicates. J. E. Thomsen (*J. Amer. Chem. Soc.*, 1908, **30**, 420—421).—One gram of the clay, &c., is heated with sulphuric and hydrofluoric acids and evaporated to dryness. The residue is dissolved in boiling water, and powdered barium hydroxide is added until the liquid is alkaline. The filtrate is freed from barium by means of a current of carbon dioxide, evaporated to 50 c.c., and mixed with 25 c.c. of strong alcohol. The precipitate is filtered off and washed with 50% alcohol, a measured excess of $N/10$ hydrochloric acid is added, and the carbon dioxide expelled by boiling, using litmus as indicator, and the excess of acid is then titrated with $N/10$ sodium hydroxide. The solution is then evaporated to dryness and the mass gently ignited, when the residue represents potassium and sodium chlorides. After allowing for the sodium chloride introduced, all data are obtained for calculating the amount of the alkali metals in the clay. L. de K.

Evaluation of Barium Peroxide. A. Chwala (*Zeitsch. angew. Chem.*, 1908, **21**, 589—592).—A criticism of the large number of processes proposed from time to time for the valuation of barium peroxide. The only trustworthy methods appear to be Quincke's gasometric method and Mohr's iodometric process.

In practice, it is, however, quite sufficient to titrate the peroxide with standard permanganate in presence of hydrochloric and sulphuric acids. L. de K.

Estimation of Magnesium Oxide in Magnesites. Josef Mayrhofer (*Zeitsch. angew. Chem.*, 1908, **21**, 592—593).—Five grams of the finely-powdered mineral are decomposed by heating with nitrohydrochloric acid on the water-bath. The dry residue is heated at 180—200° for half an hour in order to render the silica insoluble, treated with a little more acid, and dissolved in water; the filtrate is then made up to 1 litre.

Forty c.c. of the solution (or 20 c.c. in the case of burnt magnesites) are mixed in succession with 5 c.c. of sulphuric acid, 100 c.c. of citrate solution (100 grams of citric acid and 333 c.c. of ammonia, D 0·91, made up to a litre), 20 c.c. of 10% disodium hydrogen phosphate, and 15 c.c. of ammonia. The mixture is stirred for five minutes, avoiding touching the walls of the beaker, and then left at rest for two hours. The triple phosphate is collected and ignited as usual. Calcium is not precipitated, owing to the ammonium citrate. L. de K.

Action of Hydrogen Sulphide on Alkaline Solutions of Zinc Salts. LeRoy W. McKay (*J. Amer. Chem. Soc.*, 1908, **30**, 376—378).—Experiments proving that, when a rapid current of hydrogen sulphide is passed through a solution of zinc containing free sodium hydroxide, the hydrated zinc sulphide precipitated at first is gradually redissolved, and there is considerable danger of the zinc escaping recognition altogether. L. de K.

Volumetric Estimation of Zinc. Wm. Herbert Keen (*J. Amer. Chem. Soc.*, 1908, **30**, 225—233).—With due precautions, satisfactory results may be obtained by titration with standardised ferrocyanide, using the spot test with uranium acetate as indicator.

Other metals present should be removed first by suitable means.

L. DE K.

Electrolytic Analysis. ALEXANDER CLASSEN (*Zeitsch. Elektrochem.*, 1908, **14**, 141—142). F. MOLLWO PERKIN (*ibid.*, 143).—A continuation of the discussion about priority with Foerster (this vol., ii, 226). Perkin remarks that rotating electrodes were first described by Gooch and Medway, Edgar Smith, and himself almost simultaneously in 1903. T. E.

Influence of Temperature on the Electrolytic Precipitation of Copper from Nitric Acid. JAMES R. WITHROW (*J. Amer. Chem. Soc.*, 1908, **30**, 381—387).—A series of experiments from which the following conclusions are drawn. The smallest amounts of nitric acid have a tendency to retard the electrolytic precipitation of copper, but its presence is nevertheless desirable on account of its beneficial effect on the character of the deposit. Whilst in general an increased temperature means an accelerated precipitation, this is not the case above 70° if a low current strength is used. L. DE K.

Microchemical Analysis: The Silver Group. NICOLAAS SCHOORL (*Zeitsch. anal. Chem.*, 1908, **47**, 209—234).—The process is based on the characteristic microscopical appearance of the chlorides (and other compounds) of silver, lead, and mercury. The mixture of the three salts is treated with suitable solvents (ammonia, nitrohydrochloric acid, &c.), from which the compounds are then crystallised on an object glass; in some cases, sublimation is resorted to.

L. DE K.

The Estimation of Lead, Copper, and Silver in Complicated Organic Salts. M. RINDL and HUGO SIMONIS (*Ber.*, 1908, **41**, 838—840).—The methods of estimating metals in salts of organic acids containing halogen, sulphur, or nitrogen have been examined critically. Lead salts are best evaporated with concentrated sulphuric acid. In compounds containing more than the equivalent of sulphur to lead, the analysis may be combined with the sulphur estimation by the Carius method; the lead is weighed as sulphate, and the excess of sulphuric acid as barium sulphate.

The methods for estimating copper as oxide by heating and continually adding ammonium nitrate or mercury oxide are very unsatisfactory; excellent results are obtained by evaporating the copper salt with concentrated sulphuric acid. Copper salts containing sulphur or nitrogen are converted quantitatively into copper oxide on ignition.

Silver may be estimated in salts containing halogen by heating in a Carius tube with fuming nitric acid in presence of potassium halide. Quicker is the method of Dupont and Freundler of evaporating with aqua regia (hydrobromic acid being used for salts containing bromine). Silver salts containing sulphur and nitrogen give metallic silver when ignited, but require a very high temperature. E. F. A.

New Method of Estimating Mercury Vapour in Air. P. MÉNIÈRE (*Compt. rend.*, 1908, **146**, 754—756).—One hundred or one thousand litres of air, according to the proportion of mercury vapour present, are aspirated by means of a water pump at the rate of one litre per minute through 125 grams of boiling nitric acid (40° Baumé) contained in a flask to which an air-cooled Lebel-Schloesing condensing worm is attached vertically. The latter is surmounted by a smaller water-cooled worm, and, after leaving this, the air is compelled to pass through a second apparatus precisely similar to the first, the flask of which, however, contains only 75 grams of acid. At the end of this operation, the total weight of the acid should be almost exactly 200 grams; if it is not, the rate of passage of the air has been incorrect, or the condensers have been insufficiently cooled.

The acid solution is very slowly evaporated at 50° until only four to five drops of liquid remain, to which 20 c.c. of water are added. Two methods are adopted for the estimation of the mercury in this solution, according as it contains (1) less than, or (2) more than, $\frac{1}{10,000}$th of its weight of mercury. In the first case, 1 c.c. of a reagent, prepared by digesting 0·25 gram of diphenylcarbazide with 100 c.c. of alcohol at 40° for twenty-four hours and then filtering, is added to 5 c.c. of the solution, which must not contain more than 0·5% of nitric acid, contained in a graduated tube. A chart is given showing the colours produced by this reagent with solutions containing from 0·01% to 0·000025% of mercury, and the colour observed is compared with this scale, the proportion of mercury being thus deduced. If the colour produced is darker than the darkest on the chart, the second method is applied. This consists in titrating 5 c.c. of the solution with a standard solution of sodium iodide, the latter being added very slowly drop by drop, the end of the reaction being determined by the complete solution of the mercuric iodide first precipitated.

The author suggests that the method could be used for measuring the vapour pressure of mercury. E. H.

Estimation of Mercuric Chloride in Pastilles. ENRICO RIMINI (*Boll. chim. farm.*, 1908, **47**, 145—147. Compare Saporetti, Abstr., 1908, ii, 133).—The mercuric chloride is reduced to the metal by hydrazine; the volume of the nitrogen evolved may be measured, or the reduction may be carried out in a Geissler carbon dioxide apparatus, and the nitrogen estimated by loss of weight. More simply, for each gram of mercuric chloride in solution, about 20 c.c. of a cold saturated solution of hydrazine sulphate are added; the solution is then rendered neutral to methyl-orange, and 10 c.c. of *N*-sodium hydroxide (per gram of $HgCl_2$) are run in. After shaking, the mercury is filtered off and washed, and the filtrate is titrated back with *N*/10 acid. The calculation is based on the equation: $N_2H_4,NaHSO_4 + 2HgCl_2 + 5NaOH = 4NaCl + Na_2SO_4 + 2Hg + N_2 + 5H_2O$. G. B.

Use of Ammonium Persulphate in the Separation of Manganese [from Copper] in Acid Solutions. WILLY GOTTSCHALK (*Zeitsch. anal. Chem.*, 1908, **47**, 237—240).—Ammonium persulphate may be used for the separation of manganese from copper. Forty c.c. of the liquid are mixed with 10 c.c. of a 10% solution of the reagent and gradually heated to 60°. After four hours, the temperature is raised to 70°. The manganese dioxide so obtained is free from copper if washed with water containing 2% of nitric acid. L. DE K.

Separation of Iron from Indium. FRANK C. MATHERS (*J. Amer. Chem. Soc.*, 1908, **30**, 209—211).—The metals may be separated by electrolysis, but the indium so obtained still contains iron. From this, it may be freed by redissolving in acid, neutralising with ammonia, and adding an equal volume of 50% acetic acid. From this solution, the iron may now be precipitated completely by addition of nitroso-β-naphthol dissolved in 50% acetic acid. L. DE K.

A Separation of Iron from Manganese. RICHARD B. MOORE and IVY MILLER (*J. Amer. Chem. Soc.*, 1908, **30**, 593—594).—The whole of the iron is precipitated when pyridine is added to a solution of the metal containing free hydrochloric acid, whilst aluminium, chromium, and zinc are only partly precipitated, and manganese, nickel, and cobalt remain in solution. This method can therefore be used to separate iron from the last three metals. In the present paper, it is shown that a fairly satisfactory separation of iron from manganese can be effected with one precipitation. The ferric hydroxide precipitate must be washed with pyridine water (1 : 500). The manganese in the filtrate cannot be completely precipitated by the addition of bromine water to the hot solution; it may, however, be estimated by boiling the solution with potassium carbonate or sodium hydroxide. W. H. G.

Detection of Nickel in Ores and Nickel-Steel. HERMANN GROSSMANN (*Chem. Zeit.*, 1908, **32**, 315—316).—The solution obtained in the usual way is precipitated, if necessary, with hydrogen sulphide, and the filtrate is concentrated to a small volume. After neutralising the bulk of the free acid, 4 grams of sodium potassium tartrate are added for every gram of ore or alloy taken. A slight excess of ammonia is now added, and then 1 gram of dicyanodiamidine sulphate, followed by aqueous potassium hydroxide. The nickel is deposited immediately or after some little time in the form of a beautifully crystallised dicyanodiamidine compound. In presence of much manganese, it is advisable to add also some hydrazine sulphate to prevent oxidation, and subsequent separation of higher oxides of manganese. L. DE K.

Detection of Gold, Silver, and the Platinum Metals by means of the Metaphosphate Bead. JULIUS DONAU (*Zeitsch. Chem. Ind. Kolloide,* 1908, **2**, 9, 273).—As in the case of borax, certain metallic salts are reduced in metaphosphate beads, and, owing to the high viscosity of the fused mass, the ultramicroscopic particles of metal unite together so slowly that the colloidal state is evident. Continued heating causes the colour of the bead to change, and finally to disappear as the union of the metallic particles to a non-colour-producing size proceeds. These metallic aggregates in the colourless bead can easily be seen under the microscope. Decolorised metaphosphate beads do not regain their colour when reheated, the colloidal state not being reversible as with gold ruby glass. Small quantities of foreign substances, such as alkali salts, silicic acid, or water glass, have no effect on the colour produced. As an indication of the sensitiveness of this test, beads containing 0·00003 mg. of gold, 0·0002 mg. of silver, or 0·00008 mg. of platinum show distinct colours. J. V. E.

Estimation of the Hardness, also of the Free, Semi-combined, and Combined Carbon Dioxide in Waters. Hermann Noll (*Zeitsch. angew. Chem.*, 1908, **21**, 640—641).—A criticism of the processes now in vogue, and a plea for uniformity in technical water analyses. L. de K.

Estimation of Organic Carbon in Waters. Nikolaus Popowsky (*Arch. Hygiene*, 1908, **65**, 1—16).—A suitable quantity of the water is acidified with sulphuric acid and evaporated to about 8 c.c. This is then submitted to the ordinary moist combustion in a current of air (heating with sulphuric acid and potassium dichromate, and passing the dried gases through a tube containing copper oxide heated to redness and lead peroxide heated at 150°), and the carbon dioxide formed is passed through a weak solution of sodium carbonate containing phenolphthalein. From the degree of bleaching as observed in a colorimeter, the amount of carbon dioxide can be ascertained, or the excess of sodium carbonate may be titrated with water containing a known amount of carbon dioxide, but this is not quite so satisfactory.

For minute working details, the original paper and the accompanying curve should be consulted. L. de K.

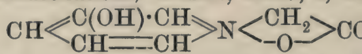
Estimation of Benzene in Illuminating Gas. Louis M. Dennis and Ellen S. McCarthy (*J. Amer. Chem. Soc.*, 1908, **30**, 233—247).—Sulphuric acid, D 1·84, cannot be recommended as an absorbent for benzene, as it also combines with varying amounts of ethylene ; it also causes much inconvenience, owing to foaming. An ammoniacal solution of nickel cyanide, however, gives trustworthy results. This reagent is prepared by dissolving 50 grams of crystallised nickel sulphate in 75 c.c. of water, and adding 25 grams of potassium cyanide dissolved in 40 c.c. of water ; the nickel cyanide formed is then dissolved by addition of 125 c.c. of ammonia, D 0·91.

A Hempel apparatus may be employed, filled with either water or mercury as the confining liquid. L. de K.

Detection and Estimation of Small Quantities of Benzene in Alcohol. David Holde and G. Winterfeld (*Chem. Zeit.*, 1908, **32**, 313).—One hundred c.c. of the spirit to be tested are diluted with so much water that the amount of real alcohol equals 24·7% by weight. The liquid is then distilled until 10 c.c. have been collected in a tube immersed in ice. The distillate is diluted with 10—20 c.c.

of water, and introduced into a narrow graduated cylinder; if the liquid remains turbid, the cylinder may be heated slightly in the water-bath. The volume of the benzene is then read off. A correction of +0·3% should be applied. L. de K.

Estimation of Alcohol in Concentrated Ethyl Nitrite. W. A. Pearson (*Amer. J. Pharm.*, 1908, 80, 101—105).—The method described originally by Dupré, subject to certain modifications, was found to be trustworthy. For the separation of the alcohol from the ethyl nitrite, from 25 to 30 grams of the concentrated preparation were weighed out in a flask partly filled with ice-water, and the flask was connected immediately with a series of wash-bottles containing cold water. The outlet tube of each bottle reached nearly to the bottom of the next one. The ethyl nitrite was allowed to evaporate at the ordinary temperature for three days. Instead of the wash-bottles, spiral condensers partly filled with water were also employed with good results. When the volatilisation of the ethyl nitrite was complete, the water in the flask and wash-bottles was transferred to a graduated flask and diluted, so that each 20 c.c. contained from 0·1 to 0·3 gram of alcohol. Twenty c.c. of this solution were then placed in a bottle, sufficient sulphuric acid and potassium dichromate to oxidise the remaining traces of ethyl nitrite and the alcohol were added, the bottle was closed securely, and heated for two hours in a boiling water-bath. When cold, the excess of chromic acid was reduced by the addition of zinc, the mixture was distilled, and the acetic acid determined in the distillate and calculated into alcohol. Any ethyl nitrite, or aldehyde, in the alcoholic solution was estimated separately, and an allowance was made for the quantities found. W. P. S.

Quantitative Estimation of Methoxyl- and Methylimino-groups. Alfred Kirpal (*Ber.*, 1908, 41, 819—822. Compare Busch, Abstr., 1902, i, 501; Goldschmiedt and Hönigschmid, Abstr., 1903, ii, 578; Goldschmiedt, Abstr., 1907, i, 30, 894).—3-*Hydroxypyridinebetaine*,  $CH<\begin{matrix}C(OH)\cdot CH\\CH{=\!=}CH\end{matrix}>N<\begin{matrix}CH_2\\-O-\end{matrix}>CO$, has been prepared by the condensation of 3-hydroxypyridine with chloroacetic acid; the *methyl ether* is obtained by the action of methyl iodide on the silver salt. On carrying out methoxyl estimations with this substance by Zeisel's method, values were obtained which were always too low; this was probably due to the wandering of the methyl group from the oxygen to the nitrogen atom, similarly to the case observed by Decker and Solonina (Abstr., 1902, i, 767). The method of Herzig and Meyer (Abstr., 1895, ii, 296; 1896, i, 68; 1898, i, 53) for estimating methyl attached to nitrogen was therefore employed, but the values so obtained were too high. This was undoubtedly due to partial decomposition of the substance, since 3-hydroxypyridinebetaine, which does not contain any methyl group, yields methyl iodide when treated according to the Herzig-Meyer method. It is therefore evident that untrustworthy results may be obtained by the methods of Zeisel and Herzig-Meyer. This problem is under investigation, and it appears that the position of the hydroxyl group exerts a great influence on the stability of the betaine. W. H. G.

The Keeping Power of Fehling's Solution, and the Volumetric Process of Estimating Reducing Sugars with it. Francis Watts and Harold A. Tempany (*J. Soc. Chem. Ind.*, 1908, **27**, 191—193).—The authors find that Violette's modification of Fehling's solution may be kept ready mixed for many months without fear of deterioration if light and air are not allowed to have access to it. In the estimation of reducing sugars, the indicator employed consisted of a potassium ferrocyanide solution acidified with acetic acid. When the titration was nearly completed, a drop of the copper solution was placed on a layer of three pieces of filter paper, and the lowest one was then tested with the indicator. The sugar solutions used in the titrations were prepared so as to contain approximately the same concentration of reducing sugar, and a correction was applied for the influence of sucrose on the titrations. Under the conditions of the experiments, this correction was in the proportion that 1 gram of sucrose is equal in reducing power to 0·0033 gram of invert sugar.

W. P. S.

Comparative Investigations on Various Reduction Processes for the Estimation of Dextrose. Tōsaku Kinoshita (*Biochem. Zeitsch.*, 1908, **9**, 208—230).—The following methods were investigated: those of (1) Allihn, (2) Knapp, (3) Pavy as modified by Kumagawa and Sutō. Estimations were made with solutions of dextrose in strengths varying from 0·1% to 0·7%. The most accurate results were in all cases obtained with a dextrose solution of 0·2%. The Allihn and modified Pavy methods were found on the whole the more accurate, showing a mean error of 0·04% and 0·02% respectively, as compared with an error of 1·730% in the Knapp method. Owing to the ease with which the Pavy-Kumagawa-Sutō method can be carried out, it is recommended in preference to the others, especially for the estimation of sugar in urine. S. B. S.

Estimation of Sugar by Allihn's and Meissl's Methods. H. Schaumann (*Zeitsch. anal. Chem.*, 1908, **47**, 235—237).—The troublesome handling of the hot porcelain dish in which the precipitation of the sugar by means of Fehling's solution takes place, and the continual filling of the filtering tube, may be avoided by using the author's arrangement, in which the supernatant liquid, and afterwards the precipitate also, is removed by suction. L. de K.

Estimation of Aldehydes by the Spectroscope. Pierre Bruylants (*Bull. Acad. roy. Belg.*, 1907, 955—977. Compare Abstr., 1907, ii, 656).—The change in the absorption bands, which is observed when a solution of defibrinated blood, to which yellow ammonium sulphide has been added, is treated with a solution containing an aldehyde, can be employed for the quantitative estimation of aldehydes. The measurement depends on the fact that the time which elapses between the mixing of the aldehyde and blood solutions and the appearance of the absorption band with a maximum at $\lambda = 560$ is inversely proportional to the concentration of the aldehyde.

The mode of operating, which is comparative, is illustrated by the estimation of citral in essence of lemon. The natural essence to be examined and an artificially prepared essence, in which the aldehyde originally present has been removed and in its place a known quantity added, are treated simultaneously with the solution containing defibrinated blood and yellow ammonium sulphide, and are then observed together in the spectroscope. If the absorption band ($\lambda = 560$) makes its appearance at the same moment in the two solutions, the percentage concentration of the aldehyde in the two solutions is the same. If the bands do not appear simultaneously, the amount of citral in the artificial essence is varied until this is the case. H. M. D.

Some Colour Reactions of Organic Acids with Phenols. Henry J. H. Fenton and G. Barr (*Proc. Camb. Phil. Soc.*, 1908, **14**, 386—387).—The authors have tabulated the colour reactions which are produced when formic, oxalic, dihydroxytartaric, pyruvic, *aa*-dimethylglutaric, lactic, saccharic, lævulic, and oxalacetic acids and their salts or esters are treated at the ordinary temperature with resorcinol, phenol, pyrogallol, or *o*-cresol in the presence of strong sulphuric acid. P. H.

Estimation of Lactic Acid in Lactates. Johannes Paessler (*Chem. Zentr.*, 1908, i, 66; from *Collegium*, 1907, 388—392).—In the absence of other reducing substances, the process is as follows: 0·4 gram of the lactate is dissolved in water, 10 c.c. of dilute sulphuric acid are added, and the lactic acid is fully oxidised to acetic acid and carbon dioxide by boiling for an hour in a reflux apparatus with addition of 25 c.c. of *N*/2 potassium dichromate. When cold, the excess of dichromate is estimated iodometrically as usual. One c.c. of dichromate = 0·01127 gram of lactic acid. Lactic anhydride is but imperfectly oxidised, and should therefore be first digested with a slight excess of alkali hydroxide. Antimony, if present, should be removed by hydrogen sulphide, and the excess of the latter boiled off. L. de K.

Estimation of Lactic Acid in Musts and Saccharine Liquids. Ludwig Legler (*Chem. Zentr.*, 1908, i, 299—300; from *Arb. hyg. Instituten, Dresden*, 2, 91—108).—The solution is concentrated to 10 c.c. and shaken thrice in succession with ether for five minutes. The ethereal residues are neutralised with barium hydroxide and then treated according to Möslinger (*ibid.*, 1902, ii, 1386). The result, however, is too low, but this may be remedied by multiplying by 1·11. L. de K.

Estimation of Benzoic Acid in Ketchup. Charles H. LaWall and Henry A. Bradshaw (*Amer. J. Pharm.*, 1908, **80**, 171—172).—Twenty grams of the ketchup are mixed thoroughly with 5 c.c. of hydrochloric acid and 25 c.c. of saturated sodium chloride solution; the mixture is then poured on a moistened filter, and the residue is washed with saturated sodium chloride solution until the filtrate and washings amount to 100 c.c. The filtrate is shaken with three successive quantities of chloroform, and the united extracts are evaporated at the ordinary temperature. The residue, which is usually perfectly white and crystalline, is dried to constant weight over sulphuric acid. If the residue is yellow in colour and oily, it must be dissolved in dilute ammonia, and the solution again shaken with chloroform, after acidifying with sulphuric acid. The weighed residue may be dissolved in a little alcohol, and the solution titrated with $N/20$ potassium hydroxide solution, using phenolphthalein as indicator, the quantity of alkali used being then calculated into benzoic acid. If salicylic acid and "saccharin" are also present in the ketchup, they are extracted along with the benzoic acid, and must be estimated separately. W. P. S.

Estimation of Glycine in Human Fæces. FELIX VON OEFELE (*Pharm. Zentr.-h.*, 1908, **49**, 203—204).—The crude glycine, obtained in the usual manner, is converted into hippuric acid by means of benzoyl chloride. The nitrogen of the hippuric acid is then estimated and calculated into glycine.

As much as 7·54% of glycine has been found in dried fæces.

L. DE K.

Estimation of Fat in Samples of Fæces and Food-stuffs by the Kumagawa-Sutō Method. RYOTARO INABA (*Biochem. Zeitsch.*, 1908, **8**, 348—355).—The fat was estimated in the samples by extraction with ether and weighing the extract (Soxhlet's method). The extract was hydrolysed and the fatty acids determined, and the fat recalculated from these results. (*A*). The residue, from the ether extraction, was treated with alkalis and the fatty acids (purified by petroleum as in the Kumagawa-Sutō method) determined, and, from the numbers so obtained, the fat in the residue calculated (*B*). Finally, the fat was determined in the whole samples by hydrolysis with alkalis by the Kumagawa-Sutō method. The determinations by the Soxhlet method were always lower than those of the direct Kumagawa-Sutō method (which did not differ much from *A* and *B*); the results generally confirm those described by Kumagawa and Sutō (this vol., ii, 331).

S. B. S.

Determination of the Saponification Number. HUGO MASTBAUM (*Chem. Zeit.*, 1908, **32**, 378—379).—When applying the Köttstorfer method for the determination of the saponification number of fats, it is desirable that the alcoholic potassium hydroxide should be as near as possible colourless and also keep so for a reasonable time. A serviceable solution is obtained by dissolving 30 grams of potassium hydroxide in 25 c.c. of water and diluting to a litre with 96% alcohol, which has been rectified over sodium hydroxide. If now the solution is preserved in colourless bottles and exposed to daylight, it will keep remarkably well. Solutions which have turned so yellow as to be useless, may be rendered again serviceable by exposure to sunlight. L. DE K.

Detection of Methylamines in the Presence of Ammonia. L. Tsalapatini (*Chem. Zentr.*, 1908, i, 299; from *Bull. Soc. Stiinte Bucuresci*, 1907, **16**, 167—169).—The solution of the mono-, di-, or tri-methylamine is neutralised with hydrochloric acid and evaporated to dryness. The residue is dissolved in 95% alcohol, and 5 c.c. of the solution heated at 70—75° with a few centigrams of tetrachlorobenzoquinone, when a violet coloration appears. Ammonia gives no reaction in those circumstances. L. de K.

Volumetric Estimation of Mustard Oil. Max Kuntze (*Arch. Pharm.*, 1908, **246**, 58—69).—The following method is recommended for the estimation of mustard oil (allylthiocarbimide) in its alcoholic solutions. Five c.c. of the solution containing about 2% of the oil are placed in a 100 c.c. flask together with 10 c.c. of ammonia and 50 c.c. of $N/10$ silver nitrate solution. The flask is then attached to a reflux apparatus, and the contents are heated for one hour by means of a boiling water-bath. After cooling, the solution is diluted with water to a volume of 100 c.c. and filtered. Fifty c.c. of the clear filtrate are then rendered slightly acid with nitric acid, 1 c.c. of ammonium ferric sulphate is added, and the excess of silver nitrate is titrated with $N/10$ ammonium thiocyanate solution. W. P. S.

[Detection and Estimation of] "Saccharin." Giovanni Parmeggiani (*Boll. chim. farm.*, 1908, **47**, 37—38).—See this vol., i, 267.

Detection of "Saccharin" (*o*-Benzoicsulphinide) in Fatty Oils. A. Bianchi and E. di Nola (*Boll. chim. farm.*, 1908, **47**, 183—185).—The authors give two methods for detecting *o*-benzoicsulphinide in fatty oils, the more expeditious being as follows.

The oil is saponified by heating on the water-bath with alcohol and not much more than the requisite quantity of potassium hydroxide solution, most of the alcohol being then removed by evaporation and the residual soap dissolved in water. To this solution is added concentrated magnesium chloride or sulphate solution, the liquid being separated from the insoluble magnesium compound by decantation and washing. This aqueous solution is concentrated on the water-bath, acidified with sulphuric acid, and shaken with a mixture of ether and light petroleum, the ethereal solution being separated and evaporated to dryness on a water-bath. The presence of *o*-benzoicsulphinide in the residue is detected by the sweet taste, and by the formation of salicylic acid on fusion with sodium hydroxide at 250°. T. H. P.

Estimation of Total Alkaloids in Coca Leaves. Anne W. K. de Jong (*Chem. Weekblad*, 1908, **5**, 225—229. Compare Abstr., 1905, ii, 778).—A criticism of Greshoff's method (*Pharm. Weekblad*, 1905, **2**, 286). The results obtained by this process show great differences from those got by the Keller–de Jong method. This is caused by loss of alkaloid, due to overheating the solutions, and also to imperfect ether extraction, owing to the emulsion formed. The process may, however, be trusted when worked as follows.

The alcoholic solution is evaporated in vacuum, the residue is dissolved in water, and then made alkaline with ammonia. Two successive shakings with ether now suffice to remove all the alkaloid. In one instance, the author's process gave 1·82% of alkaloid, whilst the Greshoff method showed but 1·60%. But when using the above modification 1·83% was obtained. L. DE K.

Evaluation of Java Coca. MAURITS GRESHOFF (*Chem. Weekblad*, 1908, **5**, 253—256).—A reply to de Jong (see preceding abstract). The author's method is intended as a guide to manufacturers, whereas de Jong's process gives results which cannot be realised in practice. L. DE K.

Estimation of Indole in Fæces. WACLAW VON MORACZEWSKI (*Zeitsch. physiol. Chem.*, 1908, **55**, 42—47).—About 30—40 grams of the fæces, when the dry substance is about 20%, or correspondingly larger quantities with liquid fæces, are mixed with 700 c.c. of water. The mixture should be neutral or weakly alkaline. Five hundred c.c. are then distilled off, best in a Kjeldahl distillation apparatus. Of the distillate, about 150 c.c. are taken, acidified with ten drops of concentrated sulphuric acid, and well shaken with 1 gram of kieselguhr. A slight loss of indole is caused by the adsorption of the kieselguhr, but this is constant when the working conditions are always the same. The mixture is then filtered, and 100 c.c. of the clear filtrate are used for the test. To this five to ten drops of a 2% sodium nitrite solution are added, and the whole is left until the maximum colour reaction is produced, which takes about two hours. The colour is then compared with a standard in a Wolff colorimeter. The standard is made by diluting 1 c.c. of a 1% solution of pure indole to 500 c.c. Five c.c. of this diluted solution are then made up to 100 c.c., to which ten drops of concentrated sulphuric acid and five drops of 2% sodium nitrite are added. The standard solution must be freshly prepared. The distillate from the fæces is sometimes somewhat coloured; in this case, it is advisable to bring the standard to the same colour by the addition of tropæolin or dichromate solution.

S. B. S.

Iodometric Estimation of Basic Colours. LOUIS PELET-JOLIVET and V. GARATI (*Chem. Zentr.*, 1908, i, 303; from *Bull. Soc. Vaudoise Sci. Nat.*, 1907, [v], **43**, 30—38).—One gram of the colouring matter is dissolved in water to a litre, and 40—100 c.c. of the solution are titrated with iodine solution containing 5 grams of iodine per litre. The end reaction is ascertained by applying the spot-test with starch solution on a porcelain plate. Satisfactory results were obtained with *magenta*, *safranin*, *methylene-blue*, and *chrysoidin*, which all give precipitates. One mol. of the dye absorbs 2 atoms of iodine.

L. DE K.

Volumetric Estimation of Dyes. LOUIS PELET-JOLIVET and V. GARATI (*Chem. Zentr.*, 1908, ii, 303; from *Bull. Soc. Vaudoise Sci. Nat.*, 1907, [v], **43**, 1—29).—The process is based on the fact that basic dyes are more or less completely precipitated by addition of acid dyes, and, if the dyes are of a different colour, the end reaction may be observed by a spot-test on filter-paper. It is best to use solutions containing 0·2—0·5% of the colouring matter. In this manner, satisfactory results are obtained in the titration of *methylene-blue* with crystal-ponceau, sodium carminate, pyramin-orange B, cotton-brown; *safranin* with helvetia-blue, naphthol-yellow S, acid-violet 6BN; *magenta* with alkali-blue, helvetia-blue, bluish-light-green SF. Reversely, the acid dyes may be titrated with the basic colours. L. DE K.

Colour Reactions in Biochemistry. I. F. A. STEENSMA (*Biochem. Zeitsch.*, 1908, 8, 203—208).—The colour reactions employed in biological chemistry can be generally classified in groups. The first of these is designated the "aldehyde-acid" group. An aromatic or heterocyclic aldehyde in the presence of a mineral acid gives a colour with either phenols or heterocyclic compounds containing the grouping C⚌CH. The colour obtained by this reaction can be changed by the addition of nitrous acid. A general reaction is suggested to account for the colour formation in the reactions of this aldehyde-acid group, and it can be shown that a large number of the biochemical reactions are included in it. Furthermore, on the assumption that the interaction of phenols or heterocyclic compounds containing the grouping C⚌CH with all aromatic aldehydes in the presence of mineral acids always give rise to colours, new reactions can be predicted; for example, certain new colour reactions of thiophen are described. It is proposed to consider other groups of colour reactions in a subsequent communication. S. B. S.

Detection of the Bile Pigments. F. A. STEENSMA (*Biochem. Zeitsch.*, 1908, 8, 209).—The Salkowski-Huppert reaction often gives negative results even when bile pigments are undoubtedly present in the urine. This is due to the fact that the bilirubin is not always oxidised. The oxidation can be conveniently accomplished in this test when the result is negative, by the addition of one drop of a 0·5% sodium nitrate solution. S. B. S.

Blood and Red Pigmented Urines. ALBERT FLORENCE (*J. Pharm. Chim.*, 1908, [vi], 27, 145—151. Compare Abstr., 1907, ii, 827).—Urobilin cannot always be detected in the urine by the ordinary method. If, however, urine is treated with hydrochloric acid, the urobilin is set free from its combination with salts, and can be extracted with ethyl acetate, which assumes a yellow colour; this solution then gives the ordinary spectrum of urobilin, but not the reaction with alcoholic zinc acetate. On keeping, it assumes an orange colour, which becomes yellow again on treatment with ammonium sulphide. The dark-coloured solution gives the zinc acetate reaction. This method of treatment is recommended for the examination of pathological urines. S. B. S.

The Reactions for Bile Pigments in Urine. J. C. SCHIPPERS (*Biochem. Zeitsch.*, 1908, **9**, 241—243).—A comparative investigation was made of the sensitiveness of the reactions of Nakayama (Abstr., 1903, ii, 120), Huppert-Salkowski, and Huppert-Salkowski as modified by Bouma. The first was found to be the most sensitive. The following modification of the Huppert-Salkowski reaction was found to give equally good results. Ten c.c. of urine are neutralised with a few drops of sodium carbonate solution, and 5 drops of 20% sodium carbonate solution and then 10 drops of 20% calcium chloride are added. The precipitate, after washing, is warmed with 3 c.c. of alcohol containing hydrochloric acid, and then sodium nitrite is added. This reaction is advantageous, in that all the reagents are colourless. S. B. S.

Estimation of the Fundamental Colouring Matter of Urines. J. BROWIŃSKI and S. DABROWSKI (*Bull. Acad. Sci. Cracow*, 1908, 139—141).—Eight hundred to one thousand c.c. of urine are defecated by means of milk of lime or else by an ammoniacal solution of the acetate of an alkaline earth metal, and the clear solution is then precipitated with copper acetate. After twenty-four hours, the urochrome-copper precipitate is collected and washed, and then decomposed by hydrogen sulphide at 50°. The filtrate is freed from excess of hydrogen sulphide by passing a current of carbon dioxide under reduced pressure, and the solution is evaporated in a vacuum to a definite volume, say, 150—200 c.c.

The liquid is now placed in a separating funnel containing carbon disulphide. Excess of iodic acid is added, and after four to six hours the iodine liberated is extracted by repeatedly shaking the contents; four extractions generally suffice. The carbon disulphide solution is then titrated for iodine in the usual manner with $N/100$ thiosulphate. 0·1319 Gram of iodine represents 1 gram of urochrome. L. DE K.

Estimation of Nitrogenous Metabolism Products in Fæces. ALBERT STUTZER, E. MERRES, and L. SEIDLER (*Biochem. Zeitsch.*, 1908, **9**, 310—317).—The nitrogenous matter in the fæces, which can be rendered soluble by treatment with gastric juice, consists of nitrogenous metabolism products, which include mucin, bile, and pancreatic secretion. The amount of this matter can be determined by estimating the total nitrogen of the fæces and the nitrogen in the residue after peptic digestion in acid solution, the amount of acid being gradually increased from 0·2% to 1%. When the fæces are not investigated in a fresh, moist condition, but are kept with preservatives, the metabolism products are apt to undergo change, so that they are no longer rendered entirely soluble by peptic digestion. An investigation showed, that of the preservatives employed, carbon disulphide produced the smallest amount of change, practically the same results having been obtained with fresh fæces and with material preserved with this substance. One c.c. suffices for 100 grams of fæces. S. B. S.

Estimation of Gliadin. WALTER E. MATHEWSON (*J. Amer. Chem. Soc.*, 1908, **30**, 74—81).—The extraction of gliadin from gluten by means of alcohol gives unsatisfactory results. With some flours, 8—17% more nitrogenous matter is extracted when 4 grams per 100 c.c. of 70 vol. % alcohol are used than when 16 grams of flour are taken. A previous drying in the water-oven also renders 10—20% of the gliadin insoluble, although pure gliadin is not affected. Propyl alcohol of 70% strength is no better suited than ordinary alcohol.

Anhydrous phenol (temperature 40°) dissolves a large percentage of protein from flour; this, however, is not pure gliadin but a mixture.

L. de K.

A New Method for Estimating Diastatic Ferments. Julius Wohlgemuth (*Biochem. Zeitsch.*, 1908, **9**, 1—9).—A series of test-tubes are taken, each containing the same amount of 1% solution of starch, but different amounts of solution of a diastatic ferment; all are placed simultaneously in a warm-bath for thirty or sixty minutes, and then transferred to ice-cold water to stop further action. Each is then shaken with the same amount of a dilute iodine solution, and the one which shows no trace of blue colour, that is, the one next to the specimen which still shows a trace of blue or violet, is taken; supposing the selected tube contains 0·02 c.c. of saliva and 5 c.c. of starch solution, and the time of exposure to 40° was 30 minutes, then 1 c.c. of saliva would have caused the disappearance of the starch in 250 c.c. of solution in the same time; this is represented by the following abbreviation in a series: $D^{40°}_{30h} = 250$.

W. D. H.

Reaction Distinguishing between Galenical Preparations made from Leaves and from other Parts of Plants. A. Richaud and Bidot (*J. Pharm. Chim.*, 1908, [vi], **27**, 278—280).—A few drops of a tincture, or other galenical preparation made from leaves, diluted with water give on careful addition of ammonia solution a yellowish-green ring at the junction of the two liquids. Preparations made from roots, seeds, or flowers do not give this colour reaction, except in the case of *Polygala* root. The substance to which the coloration is due is probably a decomposition product of chlorophyll.

T. A. H.

General and Physical Chemistry.

Refractometric Studies of Some Derivatives of Methane in which Two or Three Atoms of Hydrogen are Replaced by Negative Radicles. Albin Haller and Paul Th. Muller (*Ann. Chim. Phys.*, 1908, [viii], **14**, 125—144).—A résumé of work already published (compare Abstr., 1904, ii, 221; 1905, i, 112). The specific refractions for the α-, β-, and γ-hydrogen lines and the *D*-sodium line of the following substances have been determined: ethyl cyanoformate, D_4^{20} 1·0034, n_D^{20} 1·3821; methyl cyanoglyoxylate, n_D^{25} 1·4916; ethyl α-cyano-β-ethoxycrotonate, n_D^{25} 1·4936. A table is given of the molecular refractions for the different rays, and of the molecular dispersions between the α and γ lines. The values obtained are compared with those calculated from Brühl's data for the M_a and dispersion, and with Conrady's for M_D. It is pointed out that, whilst the optical constants for ethyl cyanoacetate, ethyl malonate, and malononitrile are not affected by solution in absolute alcohol, this solvent increases the molecular refractions by approximately one unit in the case of ethyl cyanomalonate and ethyl cyanoethylacetoacetate. This is considered to be due to increased enolisation of these substances. W. O. W.

Regularities in the Structure of Spectra. F. Stähli (*Chem. Zentr.*, 1908, i, 591—592; from *Apoth. Zeit.*, 1908, **23**, 51—53).—A theoretical paper, in which an explanation is given of the division of alkali and alkaline-earth metal spectra into primary and secondary series. The carrier of the primary series is considered to be the electrically neutral atoms, whilst the secondary series is dependent on those atoms which through loss of one or more electrons are positively charged. The connexion between the spectra of different, but closely related, elements is also discussed. J. V. E.

Spectra of the Alkali [Metals]. W. Ritz (*Physikal. Zeitsch.*, 1908, **9**, 244—245).—A criticism of Runge's conclusions (this vol., ii, 78) relative to the nature of the new series of lines discovered by Bergmann (this vol., ii, 242) in the red and ultra-red regions of the spectra of the alkali metals. The differences between the vibration frequencies of the several lines in a series are very approximately constant; this indicates that the new series are subsidiary series. This view agrees with the observed fact that the lines in these series shift towards the red end of the spectrum as the atomic weight of the alkali metal increases. Formulæ of the Rydberg type are given which represent the several lines of the series for potassium, rubidium, and cæsium. H. M. D.

Flame Spectra of Iron. Gustave A. Hemsalech and Charles de Watteville (*Compt. rend.*, 1908, **146**, 859—862. Compare this vol., ii, 336).—The spectra of iron, obtained by passing one of the gases supplied to the burner over electrodes of the metal between which an arc or sparks are passing, have been compared with the spectra obtained when the flame is fed with the spray from a solution of an iron salt. The spectra are the same for a given flame, but very considerable differences are found in the spectra when different combustible mixtures are used. Between the limits represented by $\lambda = 2250$ and $\lambda = 5000$, 750 lines were found in the iron spectrum, using coal gas and air; with coal gas and oxygen the number was 250, and with hydrogen and oxygen (or air), 210. H. M. D.

Ultra-violet Spark Spectrum of Dysprosium and Some Remarkable Magnetic Properties of this Element. Georges Urbain (*Compt. rend.*, 1908, **146**, 922—925).—The original contains a list of ninety-two prominent lines in the spark spectrum of dysprosium between the values 2872 and 4221·3. By means of the Curie and Chéneveau magnetic balance, the coefficient of magnetic susceptibility of the oxide, Dy_2O_3, obtained from six consecutive terms of one of the fractions (Abstr., 1906, ii, 359) was determined; the mean value for $x.10^{-6}$ was 290.10^{-6}, the limiting values being $286{\cdot}9.10^{-6}$ and $291{\cdot}7.10^{-6}$. Dysprosium therefore stands first in the list of paramagnetic elements, its oxide, Dy_2O_3, being 12·8 times more magnetic than the oxide of iron, Fe_2O_3; in view of this fact, the author suggests that the high values obtained by Meyer (*Sitzungsber. K. Akad. Wien.*, **110**, 492—541) for the magnetic susceptibility of rare earths fractionated by Cleve and Nilson, and containing yttrium, erbium, and holmium oxides, were probably due to the presence of dysprosium. M. A. W.

Magnetic Changes in the Spectrum of Silicon Fluoride Observed Parallel to the Field. A. Dufour (*Compt. rend.*, 1908, **146**, 810—811).—Chautard showed that the spectrum of silicon fluoride given by a Geissler tube containing this gas exhibits new rays on placing the tube in a magnetic field, and Cotton observed that the new rays persist after the action of the field, being probably due to chemical action, since the glass is attacked. The author has studied the Zeeman effect for the primitive spectrum of silicon fluoride under the conditions described previously (this vol., ii, 138), a large dispersion being employed. The spectrum is markedly sensitive to the magnetic field, and its structure is well shown by this means. The spectrum consists of diffuse rays accompanied at the red end by a background of varying intensity, the latter being often resolved into more or less widely-spaced channels. Examination of the magnetic changes parallel to the field shows that the lines may be separated into three principal groups, of which the frequencies in each group obey Deslandre's formula $N = A - (Bm + C)^2$. In the first two groups, the Zeeman effect is abnormal, and in the third group, normal. E. H.

Fluorescence, Luminescence, and Chemical Constitution. Arthur Hantzsch (*Ber.*, 1908, **41**, 1214—1216. Compare Abstr., 1907, ii, 834).—Largely polemical in reply to Kauffmann (this vol., ii, 5). Although aqueous solutions of potassium quinoldisulphonate do exhibit a very slight violet fluorescence when examined with the aid of Kauffmann's apparatus, still this fact in no way affects the main points at issue between these authors. W. H. G.

Unchangeability of the Colour of Acids of Unchangeable Constitution during the Formation of Alkali Salts and Ions. ARTHUR HANTZSCH [and, in part, ROBERT CLARK and KURT MEYER] (*Ber.*, 1908, **41**, 1216—1227).—An investigation of the intensities of solutions of hydrogen platinichloride and sodium platinichloride of widely varying concentrations and in various solvents. These substances were chosen as objects for investigation because they contain the completely saturated complex $PtCl_6$, and are consequently not affected by the solvent. It is found that equivalent solutions of the acid and of the salt in the same solvent are optically identical, that is, show the same absorption spectrum, and that the molecular absorption is independent of the degree of ionisation. The light absorption of the acid and of the salt is also unaffected by changes of temperature. The solvent does not appear to exercise any influence on the absorption in the blue and violet parts of the spectrum, but does so to a very slight extent in the green and ultra-violet.

From these results, and of work not yet published, it follows that: (1) salts, acids, or bases with completely saturated coloured complexes are optically unchangeable, no matter whether they be ionised, non-ionised, or with what colourless cation (H,M) or anion (X) they may be connected; examples: $(PtCl_6)(H_2,M_2)$; $MnO_4(H,M)$; $Cr_2O_7(H_2,M_2)$; $(CrO_4)M_2$; $[Cu(OH_2)_4]X_2$; $[Cu(NH_3)_4]X_2$.

(2) Unsaturated substances, such as anhydrous salts, which become saturated on the addition of a definite number of molecules of water (or ammonia), forming a saturated coloured complex, undergo a marked alteration in colour during this change; directly the complex is completely formed, further addition of the substance combining to form the complex produces no further effect; examples: $CuSO_4 \longrightarrow [Cu(NH_3)_4]SO_4$ or $[Cu(OH_2)_4]SO_4$. W. H. G.

Characterisation of Auxochromic Actions. ARTHUR HANTZSCH and FRIEDRICH STAIGER (*Ber.*, 1908, **41**, 1204—1213).—The auxochromic effect of various solvents on nitroquinol dimethyl ether has been investigated; further, with the object of ascertaining the influence of the so-called chromophoric nitro-group on the colour intensity, the mono-, di-, and tri-nitro-derivatives of quinol dimethyl ether, also a mono- and di-nitro-derivative of toluene, have been compared in the same solvent. The effect of isomerism on colour was also studied, nitroveratrole being compared with nitroquinol dimethyl ether, and 2:3-dinitroquinol dimethyl ether with the corresponding 2:5-dinitro-compound. In this case, it is found that the introduction of a nitro-group into various parts of the benzene nucleus is accompanied by a variable change in intensity, but the extent of the change varies with the compound.

The presence of halogens in solvents which do not contain oxygen increases the intensity of the solution, bromine and iodine, as a rule, more than chlorine; in solvents containing oxygen, this rule no longer applies; for instance, the intensities of solutions of nitroquinol dimethyl ether in ethyl chloro-, dichloro-, and trichloro-acetate decreases in the order given. With the exception of the most indifferent solvents, the effect of dissolving nitroquinol dimethyl ether is to increase its molecular intensity.

The result of introducing a second nitro-group into nitrotoluene is to increase the intensity, but the change of nitroquinol dimethyl ether into the corresponding di- and tri-nitro-derivatives is accompanied by a decrease in the colour intensity, except in the case of the solutions in methylene chloride and ethyl acetate.

From the results obtained, it is evident that the effect of solvents and substituents on the colour of substances varies considerably; in fact, the lack of laws of general applicability might be said to be characteristic of auxochromic actions. W. H. G.

Electrochemistry of Light. I. Wilder D. Bancroft (*J. Physical Chem.*, 1908, **12**, 209—278).—Evidence is adduced in favour of the suggestion of Grotthuss that the chemical action of light is analogous to that of a voltaic cell. The available data as to the action of light on salts, and its effect in promoting the oxidation of organic compounds, quoted in the form of long extracts from the writings of Eder, Vogel, Herschel, and others, are considered from this point of view. The presence of a depolariser increases or makes possible the action of light, and it is shown that in certain cases of oxidation by gaseous oxygen, the latter acts as the depolariser, whilst for reactions in which the halogens are concerned, it is usually the latter which are rendered active by light. When two substances react under the influence of light, a determination of the active rays will usually show which of the two is rendered active, and which is the depolariser. G. S.

Action of Potassium Salts on Photographic Plates. Max Levin and Rudolf Ruer (*Physikal. Zeitsch.*, 1908, **9**, 248—250).—The photographic activity of a series of potassium salts (chloride, sulphate, carbonate) obtained from different sources has been examined. All the salts examined were found to be active, the intensity of the action being equal for the various preparations. The intensity of the radiation is approximately 1/1000 of the intensity of the β-radiation of uranium oxide. Control experiments were made with sodium sulphate, lead hydroxide, and metallic lead. The sodium sulphate was found to be quite inactive; the metallic lead produced about the same effect as the various potassium salts, whereas that due to the lead hydroxide was very much smaller, and could only be recognised when the image was intensified. H. M. D

Energy of Radium. W. A. Borodowsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 460—465).—A discursive paper giving no new results. T. H. P.

Atomic Weight of Radium. Thomas E. Thorpe (*Proc. Roy. Soc.*, 1908, **80**, *A*, 298—309).—From 500 kilos. of pitchblende residues of radioactivity 2·5 compared with uranium, 413 grams of barium chloride of activity 560 were obtained. The radium chloride in this material was concentrated by 9400 fractional crystallisations, first from water and later from increasingly strong hydrochloric acid, as described by Mme. Curie. The acid employed had been distilled in a platinum retort, and the later crystallisations were carried out in vessels of fused rock crystal. It was found necessary to remove a trace of lead from the radium chloride towards the end of the series of crystallisations. Finally, 64 milligrams of radium chloride were obtained, with which two determinations were made. These 64 milligrams were supplemented by 24 milligrams of material purchased in Cambridge, and the whole was recrystallised to give 78·4 milligrams of material, with which a third determination was carried out.

The radium chloride was weighed to 0·1 milligram in a small glass vessel with a conical base and a hollow ground-in stopper. A similar vessel was used as a counterpoise, both being dried over phosphoric oxide. The chloride was dissolved in 2 c.c. of distilled water, acidified with dilute nitric acid, warmed, and mixed with slight excess of silver nitrate solution. The precipitate was washed at least six times with hot water, and the supernatant liquid siphoned off through a fine capillary tube. The washed silver chloride was dried at 100°, heated at 160°, and kept over phosphoric oxide before weighing.

The method was tested by five determinations with barium chloride, the results deviating less than 0·5% from the accepted atomic weight. Barium bromide and also barium chloride and bromide recovered from the filtrates gave similar results.

The radium chloride was recrystallised until successive crystallisations gave approximately constant atomic weights. It was then repeatedly crystallised from pure strong hydrochloric acid. Spectroscopic tests made by Sir William Huggins showed that the material contained only a trace of barium.

Two determinations of the atomic weight of radium in this chloride gave the values 226·8, 225·7, whilst the above mentioned 78·4 milligrams of material gave 227·7. The mean value, 226·7, is in close agreement with Mme. Curie's number, 226·2 (Abstr., 1907, ii, 728).

Incidentally, the author states that when radium chloride is exposed to perfectly dry air, it gains in weight, a substance with the properties of ozone is produced, and the chloride itself appears to be slightly oxidised. The quartz vessels employed in recrystallisation were gradually turned a deep purplish-black. R. J. C.

Decay of Radium *B* and *C* at High Temperatures. WALTER MAKOWER and SYDNEY RUSS (*Physikal. Zeitsch.*, 1908, **9**, 250—251. Compare Abstr., 1907, ii, 421 ; H. W. Schmidt, this vol., ii, 141).—The authors maintain the accuracy of their previous experimental observations, and consider that the results, from which Schmidt has drawn the conclusion that the rate of decay of radium *C* is independent of the temperature up to 1300°, are not inconsistent with a variation in the activity of from 5 to 10%. H. M. D.

Occurrence of Radium *D*, *E*, *F* in Ordinary Lead. JULIUS ELSTER and HANS GEITEL (*Physikal. Zeitsch.*, 1908, **9**, 289—294).—Experiments are described which indicate that the radioactivity of lead is due to the presence of radium *F*. The active substance may be conveniently isolated from "pure" lead acetate or chloride. The acetate is dissolved in water containing a little acetic acid, and the lead precipitated by addition of sulphuric acid; the fitered liquid is then treated with hydrogen sulphide, the precipitate dissolved in fuming nitric acid, and the solution evaporated to dryness after the addition of hydrochloric acid. After the residue has been treated with a little water, a copper plate is left in contact with the solution, and the radioactive substance after twenty-four hours is found to have been almost entirely deposited on the copper. The activity of the substance separated in this manner falls to half value in one hundred and forty-three days, which corresponds with the decay constant for radium *F*. The substance emits α-particles, and measurements of the range of these particles by different methods have given values slightly less than 4 cm., which is the range of the particles from radium *F*. The proof that the activity of lead is due to the presence of traces of a foreign substance is regarded as a strong argument against the assumption that all kinds of matter are more or less radioactive. H. M. D.

Influence of Radium on the Decomposition of Hydriodic Acid. H. JERMAIN M. CREIGHTON and A. STANLEY MACKENZIE (*Amer. Chem. J.*, 1908, **39**, 474—493).—In investigating the effect of light on the decomposition of hydriodic acid, Pinnow (Abstr., 1901, ii, 634) used solutions of potassium iodide acidified with sulphuric acid, and found that the best results were obtained when the potassium iodide had a concentration of 1 gram per litre. A solution of the same strength was used in the experiments now described.

Radium bromide (5 mg.) of activity about 1,000,000 was enclosed in a small glass tube, from which the β- and γ-rays were allowed to pass into the solution for a given time. The amount of decomposition was then compared with that which had taken place in a similar solution not acted on by radium. The following results were obtained.

A solution prepared with pure water of conductivity $1{\cdot}6 \times 10^{-6}$ at 18° decomposes in the dark, an equilibrium point being reached in sixty hours at 12°, twenty-three hours at 24°, and six hours at 36°. When ordinary distilled water is used, the decomposition is accelerated, owing to the catalytic action of some impurity which introduces a second reaction; in this case, the amount of iodine liberated reaches a certain maximum and then gradually decreases. At temperatures up to 24°, the amount of iodine set free in any given time from a solution of hydriodic acid in the dark is increased by exposure to radium rays. At 36°, however, in presence of radium rays, the amount of free iodine reaches a maximum in twenty-two hours and then decreases indefinitely, whereas in the absence of radium an equilibrium value is attained. This is accounted for by the supposition that at 36° radium causes the formation of the same product as is produced at lower temperatures by some impurity in the water. In general, a rise of temperature causes an increased liberation of iodine both in presence and absence of radium. The amount of iodine present at any time depends on an accelerating factor, obtained from the rate of decomposition of the hydrogen iodide into hydrogen and iodine, and two retarding factors, one depending on the rate at which the hydrogen and iodine re-unite, and the other, on the rate at which the hydrogen iodide enters into some other reaction. The rate of decomposition of the hydrogen iodide is increased by the presence of radium, but the effect is relatively smaller the higher the temperature. The constant of the larger of the two retarding factors increases with the temperature and to a greater extent than does the accelerating constant, and at the lower temperatures is very slightly affected by the presence of radium. Whereas at 12° and 24° the presence of radium increases the rate both of the accelerating and of the retarding action, at 36° it introduces a new retarding reaction, and simultaneously diminishes the retarding action already existing. It has been found that at 24° the γ-rays alone effect the liberation of more iodine than do the β- and γ-rays together. In the absence of oxygen, the hydriodic acid solution is not decomposed either by sunlight or by radium rays.

E. G.

The Influence of Radium on the Electrolytic Conductivity of Colloidal Solutions. Ladislas Żłobicki (*Bull. Acad. Sci. Cracow*, 1907, 1009—1016).—The author states that the electrolytic conductivity of colloidal metal solutions prepared by Svedberg's method differs from that of the solvent, that the conductivity is considerably affected by radium, and that it undergoes variation from day to day. Colloidal solutions of silver, copper, and gold in water, ether, alcohol, and xylene were examined.

Radium diminishes the conductivity of the solutions in alcohol, ether, and water, but increases it with xylene as solvent. The change of conductivity is complete about half an hour after the solution is first exposed to the radium, and a like period elapses after removal of the radium before the original conductivity is restored.

Radium has no influence on the conductivity of Bredig's hydrosols, or of aqueous colloidal solutions of such substances as gum-arabic and egg-albumin.

A. J. W.

Kinetics of the Transformations of Radioactive Compounds. Philippe A. Guye (*J. Chim. phys.*, 1908, 6, 294—306).—It is pointed out that the constant for the rate of decay of radioactivity with time is simply the velocity constant of the chemical reaction of the first order which the transformation follows. Further, simultaneous or successive radioactive transformations follow the law of the coexistence of chemical reactions.

In contrast with ordinary chemical reactions, the temperature-coefficient of atomic disintegration is small. Reasons are given for the view that in the familiar equation, rate of chemical action = driving force/resistance, the alteration of the "driving force" with temperature is small, and that the large temperature-coefficient for the rate of ordinary chemical reactions is due almost entirely to diminution of the resistance with temperature. It may be anticipated, however, that the resistance to atomic disintegration will remain nearly constant with change of temperature, and therefore the rate of disintegration will be nearly independent of the temperature, in accordance with the experimental facts. G. S.

Absorption of β-Rays of Radioactive Elements. OTTO HAHN and LISE MEITNER (*Physikal. Zeitsch.*, 1908, 9, 321—333).—With the object of determining whether the absorption of β-rays takes place according to an exponential formula, the absorbing action of aluminium has been examined for a number of radioactive substances. Thorium and its transformation products emit three distinct kinds of β-rays, which are due respectively to thorium $1+2$ (meso-thorium), to thorium A, and to thorium $B+C$. The last two types of rays are absorbed exponentially, but the β-rays from thorium $1+2$, the penetrating power of which is intermediate between that of thorium A and thorium $B+C$, deviate considerably from the requirements of the exponential formula. The β-rays of uranium X and radium E_2 are also found to be absorbed exponentially, and the general conclusion is drawn that exponential absorption curves correspond with homogeneous β-ray products. On the other hand, when the absorption-coefficient decreases with increasing thickness of the absorbing layer, the active substance is a mixture of β-ray products. Increase of the absorption-coefficient with the thickness of the absorbing medium is a phenomenon which probably depends on the special conditions of the experiment.

Concerning the β-rays emitted by the active deposit from thorium collected on a negatively charged wire, it has been found by two independent methods that 43% of the total ionisation is due to the β-radiation from thorium A. H. M. D.

Amount of Radioactive Emanation in Air from the Soil. ALBERT GOCKEL (*Physikal. Zeitsch.*, 1908, 9, 304—306).—The author has examined the quantity of emanation in air extracted from soil at a depth of one metre below the earth's surface under various meteorological conditions. The variations of 1 : 4 which have been observed are traced to changes in the absorptive power of the upper layers of the earth's surface, and to changes in barometric pressure. Rain and frost increase the absorptive power, resulting in an increase of the emanation content of the air below the surface. The highest observed value of the emanation concentration was at the end of a protracted period of frosty weather. H. M. D.

Relative Quantities of Ions Produced in the Atmosphere at Rome by the Solid Transformation Products of Radium and of Thorium, and the Quantity of Thorium in the Earth in that Neighbourhood. GIAN A. BLANC (*Physikal. Zeitsch.*, 1908, 9, 294—304).—It has been found that negatively charged substances exposed in the open air at Rome acquire induced activity of the thorium type. The relative proportions of this and of the simultaneously acquired induced activity of the radium type have been measured.

The ionisation of the air near the earth's surface is due to the action of (*a*) radioactive emanations, (*b*) solid transformation products of the emanations floating in the air, and (*c*) transformation products deposited on substances exposed to the air. On account of the relatively rapid decay of thorium emanation, the ionising action of this is only effective under normal conditions in close proximity to the earth's surface. At a height of 6 metres above the surface, the author found that from 5 to 10% of the ions in the air are to be referred to the activity of thorium products ($B+C$). Experiments with a wire negatively charged to a potential of about 500 volts indicate that, after sufficiently long exposure, from 40 to 75% of the active deposit consists of induced activity of the thorium type. With shorter periods of exposure, the proportion of thorium-induced activity is smaller, corresponding with the smaller value of the decay constant of thorium *A* compared with that of radium *C*.

It is probable that under the influence of the earth's electric field, the greater part of the induced thorium activity is deposited on the earth's surface. This is due to the rapid decay of the emanation, and special experiments have shown that the observed quantity of thorium emanation which escapes from the surface corresponds with the presence of 0·0000145 gram of thorium hydroxide in each gram of earth substance. This large proportion of thorium would result in the heat development associated with the processes of disintegration of thorium compounds, being of much greater importance than that resulting from the disintegration of radium compounds so far as the magnitude of geo-thermal gradients is concerned. H. M. D.

Constituents of Atmospheric Radioactivity. H. M. DADOURIAN (*Amer. J. Sci.*, 1908, [iv], **25**, 335—342; *Physikal. Zeitsch.*, 1908, **9**, 333—337. Compare Abstr., 1905, ii, 132).—The relative amounts of radium and thorium emanation in the air of New Haven and of Rome have been determined, in the latter case from the observations of Blanc (*Phil. Mag.*, 1907, [vi], **13**, 378; this vol., ii, 248). For a negatively charged wire which had been exposed to underground air (air which had filtered through the soil) for three hours, about 5% of the initial activity was found to be due to the products of thorium emanation, the remainder to those of radium emanation, whilst for a negatively charged wire exposed in the open air for four days, 20—30% of the total initial ionisation was due to thorium products, the remainder to radium products. From the last observation it is calculated that the amount of radium emanation in the air at New Haven is 30,000—50,000 times that of the thorium emanation, whilst the corresponding ratio at Rome is 20,000—30,000 : 1. G. S.

Radioactivity of Roumanian Petroleums. DRAGOMIR HURMUZESCU (*Ann. Sci. Univ. Jassy*, 1908, **5**, 1—31).—The radioactivity was measured by the electrical conductivity of air which had been bubbled through the samples of petroleum. The activity of petroleum from Câmpina-Bustenari (Prahova) and from Câmpeni-Parjol-Moinesti (Bacau) is of the same order of magnitude as that of an average mineral or thermal spring water. The activity falls to half value in a little more than three days, which is only slightly different from the time corresponding with the decay constant of radium emanation. Samples from different borings in the same neighbourhood differ somewhat in regard to their radioactivity. This depends on the nature of the geological formation of the immediate surroundings of the boring, and also on the density of the petroleum, the lighter petroleums being the more active.

The gases disengaged from a particular boring are less active than the petroleum itself, and the associated water and argillaceous mud are still less so. The radioactivity of the petroleum from a new boring is greater than that found after the boring has been worked for some time. H. M. D.

Radioactivity of Uranium Minerals. BERTRAM B. BOLTWOOD (*Amer. J. Sci.*, 1908, [iv], 25, 269—298. Compare McCoy and Ross, this vol., ii, 80, 81).—The relative activities of the various products contained in a uranium mineral (uraninite) have been determined. The methods of separation, or partial separation, of the various products are fully described. The results are as follows, the activity of uranium itself (obtained from experiments with the oxide) being taken as unity: ionium, 0·34; radium, 0·45; radium emanation, 0·62; radium *A*, 0·54; radium *B*, 0·04 (?); radium *C*, 0·91; radium *F* (polonium), 0·46, actinium products 0·28. The total activity of the mineral is thus 4·64 times that of the uranium contained in it, whilst the average value for the same ratio, obtained directly from experiments with 10 specimens of uranium minerals, is 4·69, in good agreement with the above number. The results are not absolute, as the above ratios for uranium and its disintegration products depend to some extent on the conditions of the experiment. From the above ratio and the proportion of radium in the mineral, it is calculated that one gram of radium, free from all products, has about the same activity as 1,300,000 grams of uranium. There is evidence that the amount of actinium present is proportional to the quantity of uranium, so that actinium is probably a disintegration product of uranium.

G. S.

Nomenclature of Thorium Compounds. OTTO HAHN (*Physikal. Zeitsch.*, 1908, 9, 245). **Short-lived Intermediate Product between Mesothorium and Radiothorium.** OTTO HAHN (*ibid.*, 246—248. Compare Abstr., 1907, ii, 359).—Further examination of mesothorium has shown that it represents two substances. The first (mesothorium 1) emits no rays, and has a period of decay equal to 5·5 years. By the disintegration of this substance, mesothorium 2 is formed; this emits β-rays, and its period of decay is 6·20 hours.

The two substances can be separated by adding a small quantity of zirconium chloride to the solution of "mesothorium," and precipitating by the addition of ammonia. Mesothorium 2 is precipitated with the zirconium, whilst mesothorium 1 is left in solution.

For mesothorium 1, mesothorium 2, and radiothorium, the names thorium 1, 2, and 3 respectively are suggested. H. M. D.

Polonium. WILLY MARCKWALD (*Ber.*, 1908, 41, 1378—1379).—Most of the reactions of polonium described by Giesel (this vol., ii, 342) have been observed previously by the author. J. J. S.

Ionium, a New Radioactive Element. BERTRAM B. BOLTWOOD (*Amer. J. Sci.*, 1908, [iv], **25**, 365—381).—Further experiments have shown the correctness of the earlier conclusion (Abstr., 1907, ii, 836), that uranium minerals contain a previously unidentified radioactive element. Methods are described for obtaining highly active preparations of ionium from carnotite, pitchblende, gummite, and uranophane. One of these consists in treating carnotite with hydrochloric acid and adding several grams of the chlorides of the cerite earths. The earths are then separated as oxalates, converted into chlorides, and the solution of the chlorides precipitated by sodium thiosulphate. The substance which separates is purified by repeated precipitation with sodium thiosulphate, and the resulting product has an activity several thousand times as great as that of an equal weight of pure uranium. The range of the α-particles emitted by ionium is 2·8 cm. in air at 760 mm. pressure; indications have been obtained that β-rays are also emitted. The opinion expressed previously, that ionium is the immediate parent of radium, is maintained. The rate of production of radium indicates that the life of ionium is at least as long as that of radium if it is assumed that no other product having a slow rate of change occurs between uranium *X* and ionium. The data now available point to the view that Debierne's actinium, as originally prepared, consisted of a mixture of ionium and Giesel's emanium. H. M. D.

Supposed Connexion between Dielectric Constant and Isomerising Power of Organic Solvents in Keto-Enol Desmotropy. ARTHUR MICHAEL and HAROLD HIBBERT (*Ber.*, 1908, **41**, 1080—1091. Compare Brühl, Abstr., 1899, ii, 735; 1900, ii, 11; Dimroth, 1905, i, 98, 383).—From an extended series of experiments with dibenzoylacetylmethane both in its enolic and ketonic modifications, and ethyl diacetylsuccinate in hydrogen cyanide, nitromethane, acetonitrile, methyl alcohol, propionitrile, acetaldehyde, acetone, ethyl nitrate, bromide, iodide, formate and acetate, chloroform, methylal, carbon disulphide, and benzene, the authors draw the following conclusions: (1) there is no simple relationship existing between the dielectric constant, dissociating power, association factor, heat of vaporisation, medial energy of an organic solvent, and the velocity of isodynamic change; (2) the velocity and the equilibrium constant in organic solvents are independent of one another, and the latter does not stand in any simple relation to the above physical constants; (3) the isomerising power of organic solvents is not a constant property, but is dependent on the chemical nature of the compound. In some cases, the solvent produces the ketonic, in others the same solvent promotes formation of the enolic, modification. W. R.

Electrode Potential in Liquid Ammonia. F. M. G. JOHNSON and NORMAN T. M. WILSMORE (*Chem. Zentr.*, 1908, i, 1135; from *Elektrochem. Zeitsch.*, 1908, **14**, 203—206).—The authors regard *C* in Nernst's equation $C_0 = RT/nF$ as better expressed by "electrolytic potentiality" than by "potential," and C_0 as the affinity constant of the elements; the latter they have determined in liquid ammonia.

Cadmium in a saturated solution of cadmium nitrate was chosen as normal electrode, and a slow current of hydrogen saturated with ammonia was passed through the solution so as to avoid salt formation with the atmospheric carbon dioxide. All measurements were made at $-33\cdot5°$, the b. p. of liquid ammonia, and to avoid as far as possible contact-potential between the solutions a $N/2$ solution of potassium nitrate in ammonia was used as solvent. It was found better to use a concentrated solution of lithium chloride than calcium chloride solution for rendering the quartz thread of the Dolezalek electrometer conductive.

The following metals and salts have been investigated: $AgNO_3$ and AgI with fine silver and electrolytic silver; HgI_2 with mercury; $Pb(NO_3)_2$ with lead; $Zn(NO_3)_2$ with pure zinc; MgI_2 with magnesium; $Ni(NO_3)_2$ with electrolytic nickel; $Cu(NO_3)_2$ with electrolytic copper; calcium with $Ca(NO_3)_2$; ammonium amalgam with NH_4NO_3; sodium with $NaNO_3$ and NaCl; potassium with KI. With one platinum electrode in a blue solution of alkali metal, the same *E.M.F.* was observed as with solid alkali metal electrodes, which shows that the blue colour is due to the colloidal state of the metal present. Zinc and cadmium gave the most constant values, although zinc and also magnesium blackened after a time, whilst the *E.M.F.* of nickel at first decreased, then became constant. So as to be able to compare the results with those obtained with water solutions, measurements were made with the KCl | Hg_2Cl_2 | $Hg^{\cdot}$ electrode; inasmuch as the temperature rose about 50°, a concentrated water solution of ammonia (D 0·880) was used. Referred to the hydrogen electrode, the results obtained for the *E.M.F.* are:

Cd | $Cd(NO_3)_2,4H_2O$ saturated | NH_4OH | KCl$N/10 = 1\cdot041$ volts.
Zn | $Zn(NO_3)_2,6H_2O\,N/10$ | NH_4OH | KCl$N/10 = 1\cdot403$ volts.
Hg | $HgI_2\,N/10$ | NH_4OH | KCl$N/10 = +0\cdot164$ volts.

Assuming the *E.M.F.* of the half element Cd | $Cd(NO_3)_2 4H_2O$ saturated to be 1·048 volts, the various potentials have been calculated and compared with the potential for normal ion concentrations in water solution, and it is found that the order of the series of potentials is the same in both solvents. The potential was higher throughout in ammonia than in water, and this is possibly due to a heat potential and a relatively smaller ion concentration in ammonia solution. A definite interpretation of the results is, however, not yet possible.

J. V. E.

Variation of the Electromotive Force of Liquid Chains by Polarisation of Interposed Diaphragms. PIERRE GIRARD (*Compt. rend.*, 1908, **146**, 927—929).—When a diaphragm of chromium chloride or calcined alumina is placed between a liquid couple composed of two solutions of an acid or basic electrolyte of different concentrations, the final difference of potential (p') is less than that of the original couple (p), and the difference, $p - p'$, is diminished by the addition to the solutions of salts providing multivalent ions. Thus the interposition of a diaphragm of chromium chloride in the system $N/10$HCl | $N/500$HCl gave $p - p' = 0\cdot036$ volt, and the addition of $N/100$ and $N/5000K_3Fe(CN)_6$ respectively to the acid solutions gave $p - p' = 0\cdot006$ volt. The author concludes that the variations in the voltage of liquid couples caused by diaphragms or membranes are not to be attributed to variation in the mobility of the ions in the interposed media, but are due to phenomena of contact electrification of the diaphragm (compare Perrin, Abstr., 1905, ii, 138). M. A. W.

The Decomposition Tension of Fused Calcium Chloride. KURT ARNDT and KURT WILLNER (*Zeitsch. Elektrochem.*, 1908, 14, 216—218).—The *E.M.F.* of the cell Ca | fused $CaCl_2$ | Cl_2 is determined directly and also by measuring the polarisation in the electrolysis of calcium chloride. The final results obtained in the two ways agree together and give 3·24 volts at 800°. The temperature-coefficient is $-0·004$. The corresponding value for strontium chloride is 3·40 volts at 880°; the highest value for barium chloride observed was 3·3 volts, but this is probably too low, owing to the difficulty of avoiding depolarisation. T. E.

Electrical Conductivity in Systems containing Zinc Sulphate, Ammonia, and Water. S. SHUMAKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 476—479. Compare Kuriloff, Abstr., 1906, ii, 343; Zubkowskaia, Abstr., 1907, ii, 940).—The specific conductivities were determined for the liquid phases of the systems $ZnSO_4$–NH_3–H_2O in equilibrium with compounds of the first and second classes and also with colloidal compounds (compare Kuriloff, Abstr., 1906, ii, 349). Eleven different solutions were examined, comprising the region of increasing precipitate, the region of transition, and the region of diminishing precipitate.

Separate measurements were made of the conductivities of aqueous solutions of zinc sulphate, ammonium sulphate, and ammonia of concentrations similar to those in which they exist in the systems examined. The data obtained show that, from the moment of transition from a system containing compounds of the first class to a system in which exist compounds of the second class and colloidal compounds, the latter exert an influence on the change of the conductivity. T. H. P.

Cathodic Pulverisation of Metals in Attenuated Gases. VOLKMAR KOHLSCHÜTTER and TH. GOLDSCHMIDT (*Zeitsch. Elektrochem.*, 1908, 14, 221—235. Compare Abstr., 1907, ii, 7).—The investigation of Kohlschütter and Müller (Abstr., 1906, ii, 418) has been continued with improved apparatus and methods. The loss of weight of cathodes of aluminium, iron, copper, silver, gold, and platinum in hydrogen, nitrogen, oxygen, helium, and argon at about 1 mm. pressure was studied. Great care was taken to use pure materials. The current used was produced by an induction coil, but discharges in one direction only passed through the gas. The cathodic volatilisation resembles the analogous phenomenon with a heated wire, but it is not, like the latter, appreciably affected by the admixture of small quantities of oxygen with the gas. It is not caused by the escape of occluded gases; platinum cathodes charged with hydrogen or oxygen did not volatilise any more than uncharged cathodes. When intermittent current is used (with a circular disk cathode), the loss of metal is greatest from a ring between the edge of the disk and its centre. The pressure of the gas in the tube either remains constant (helium and argon) or decreases, owing to the formation of compounds of gas and metal. When the metals are arranged in the order of their volatility (loss of weight for the same number of coulombs passed), it is found that the order is the same for all gases, and the losses are proportional to the equivalents of the metals. The quantity of metal volatilised depends also on the nature of the gas, the greater volatility being always found in the gas of higher atomic weight. The authors ascribe the volatilisation to the formation of volatile, endothermic compounds of metal and gas, which decompose on cooling. Helium and argon compounds may therefore exist under the conditions of the discharge. T. E.

Velocity of Transport of the Ions H, Cl, OH in the Electrolysis of Solutions of Hydrogen Chloride. EMMANUEL DOUMER (*Compt. rend.*, 1908, **146**, 894—896. Compare this vol., ii, 252, 349).—When a solution of hydrogen chloride is electrolysed, part of the current may be employed in electrolysing the water.

Assuming that this is the case, the transport numbers for $\overset{+}{\mathrm{H}}$ and $\overset{-}{\mathrm{Cl}}$ will differ from those obtained without taking this into account. Dilute solutions of hydrogen chloride were electrolysed by currents of 0·005 to 0·02 amperes, and the evolved hydrogen measured. The diminution in concentration of the acid was also determined and found to be the same at each electrode. Thus in one experiment 48·15 c.c. of hydrogen were liberated, corresponding with an equivalent weight of 0·158 gram of hydrogen chloride; the loss of acid at the negative pole was 0·027 gram, and at the positive pole 0·027 gram. Assuming the water to have been ionised, the loss at each pole should have been $P/3 - p = 0{\cdot}026$ gram, where $P/3$ represents the weight of acid electrolysed, and p the loss of acid at the negative pole. If the electrolysis of water does not come into play, the loss should have been $P - p = 0{\cdot}131$ gram. The conclusion is drawn, therefore, that the ionisation of water plays an important part in the electrolysis of hydrogen chloride solutions, and that the transport velocity of the H and Cl ions is the same for each ion. W. O. W.

Electrical Transport of Inorganic Colloids. ANDRÉ MAYER and EDOUARD SALLES (*Compt. rend.*, 1908, **146**, 826—829).—As a result of experiments made with colloidal arsenic trisulphide (dialysed during several weeks and having about the same conductivity as distilled water), the authors find that the transport of the colloid is not uniform. When a column of the colloid contained in a U-tube and separated from the electrodes by layers of distilled water is submitted to the action of an electric current, the velocity with which one meniscus recedes from the electrode having the same sign as the colloid is greater than that with which the other meniscus approaches the electrode of opposite sign, thus producing a contraction of the column, and the first velocity increases (to a limit), whilst the second diminishes, as the action progresses. When the transport has lasted some time, that extremity of the colloid column which approaches the electrode of opposite sign becomes more and more opaque, whilst the other extremity becomes more and more clear. On reversing the current, all these phenomena proceed in exactly the reverse manner. The intensity of the current increases as the experiment proceeds, indicating that the conductivity of the colloid is increasing, and this is found to be the case. From these facts it is deduced that (1) the electrical transport requires a certain amount of preparation; (2) the action producing this transport increases up to a certain limit; (3) the colloidal granules seem to increase in size and decrease in velocity at the extremity of the column near the electrode of opposite sign, and to diminish in size and increase in velocity at the other extremity; and (4) these phenomena are correlated with a liberation of electrolytes.

The authors advance the hypothesis that the transport of the colloid depends on that of the ions of these electrolytes, which in a pure dialysed inorganic colloid are not pre-existent, but are formed by the passage of the current, the colloid gradually decomposing into its crystalloid elements, with the ultimate production of a large number of positive and negative ions at the ends of the colloid column. This would explain (compare this vol., ii, 24) the respective aggregation and disintegration of the colloid granules. This hypothesis is supported by the observations that, whilst the field increases from 100 to 1000 volts, the maximum velocity of the colloid increases more rapidly, and that addition of potassium chloride considerably enhances all the effects described.

The conclusion is drawn that the transport of inorganic colloids, like that of organic colloids and of powders, depends on the ions adsorbed by the colloid granules. E. H.

The Electrolysis of Solutions of Hydrochloric Acid. TH. GUILLOZ (*Compt. rend.*, 1908, **146**, 581—582).—The author criticises adversely the recent conclusion of Doumer (this vol., ii, 252), that in the electrolysis of hydrochloric acid solutions part of the current is employed in the electrolysis of the solvent itself, and must be allowed for in determining the transport numbers of $\overset{+}{\mathrm{H}}$ and $\overset{-}{\mathrm{Cl}}$. The regularity of the values obtained by Noyes and Sammet for the mobility of the ions $\overset{+}{\mathrm{H}}$ and $\overset{-}{\mathrm{Cl}}$ in various dilute solutions (Abstr., 1903, ii, 126) is held to constitute an experimental proof that the ions of water do not play any part in the conduction. R. J. C.

Dulong and Petit's Law. PAUL ROHLAND (*Physikal. Zeitsch.*, 1908, **9**, 318—319).—Polemical against Wigand (this vol., ii, 13). The fact that the atomic heat has the value required by the law only within certain temperature limits is attributed to variations in the mutual action between the atoms and the ether with the temperature. H. M. D.

Specific Heat and Osmotic Pressure of Solutions. EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 339—360).—The specific heat of a dissolved substance is expressed by the equation

$C^1 = C(1 + m_o) - C_o m_o$, where C and C_o are the specific heats of the solution and solvent respectively, and m_o the weight of solvent per unit weight of solute. The equation given by Bertrand (Thermodynamique, 1887, 109) becomes, in this case, $dC^1/dV = T.d^2P/dT^2$, that is, the change of the specific heat of a dissolved substance with change of volume of the solution is proportional to the second differential coefficient of the osmotic pressure with respect to temperature. The following three cases are discussed and applied experimentally: (1) $dC^1/dV = 0$, that is, the specific heat of the solute is constant, and does not change with the concentration of the solution; as d^2P/dT^2 is also zero, the osmotic pressure must, in this case, be either a linear function of, or independent of, the temperature, both of which relations are practically possible. (2) dC^1/dV is greater than zero, that is, the specific heat of the solute increases with dilution of the solution. As, also, d^2P/dT^2 is greater than zero, the osmotic pressure is not a linear function of, but increases more rapidly than, the temperature. There are many solutions exhibiting this property, notably aqueous solutions of organic hydroxylic compounds. (3) dC^1/dV is less than zero, that is, the specific heat of the solute diminishes with dilution of the solution, and the osmotic pressure consequently increases in less than linear relation with the temperature. This behaviour is characteristic of dilute solutions of electrolytes, and stands in intimate relation to their electrical conductivity. T. H. P.

Changes of Specific Heat of Ethyl Alcohol Dissolved in Liquid Hydrocarbons. IVAN SHREDER (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 360—367).—The author has determined the specific heat of solutions of various concentrations of ethyl alcohol in naphtha, benzene, or chloroform, and of methyl alcohol in benzene, toluene, or chloroform. The values of the specific heat of alcohol in the various solutions have been calculated on the basis of the law of mixtures. It is found that the specific heat of the alcohol increases towards a definite limiting value as the concentration of the alcohol in the solution diminishes. Further, the specific heats of alcohol in solutions of equivalent concentration in benzene and naphtha are identical. The numbers thus calculated for the specific heat of alcohol in solution are regarded by the author as the specific heats of alcohol which has undergone change during solution, the values representing the measures of such change. At any given moment a solution must be looked on as a mixture of dissociated and associated products, and it is probable that every liquid is really a solution in this sense of the term. T. H. P.

Latent Heat of Vaporisation and Specific Heat of Methyl Silicate. LOUIS KAHLENBERG and ROBERT KOENIG (*J. Physical Chem.*, 1908, **12**, 290—292).—The latent heat of vaporisation of silicon tetrachloride is 36·1, and its average specific heat between 20° and 40° is 0·1904, which confirms Regnault's value; the heat of vaporisation of methyl silicate, $Si(OMe)_4$, is 46·5, and its average specific heat between 23° and 115° is 0·5011. G. S.

Evaporation of Water and Solutions of Sulphuric Acid. P. VAILLANT (*Compt. rend.*, 1908, **146**, 811—814).—It has been shown previously (*ibid.*, 582) that if the ratio of the weight of water evaporated (p) to the fall of the vapour tension ($F-f$) is constant, its value may be obtained from the expression $B = (p-p')/(F-F')$, in which p and p' are the weights evaporated in the same time from pure water (vapour tension, F) and a sulphuric acid solution (vapour tension, F'), B being independent of the concentration of the solution. The value 0·610 mg. per hour and per sq. cm. was obtained for B at 16° and 745 mm., the surface of the liquid being 5·5 mm. below the edge of the containing vessel.

Repetition of the former experiments, using a larger quantity of liquid, the surface of which was only 3 mm. below the rim of the vessel, gave the value 0·745 mg. for B at 21°. That the difference between the two results is mainly due to the smaller depth of the liquid surface below the vessel's edge in the second case is shown by the fact that with pure sulphuric acid, B increases from 0·652 mg. when this depth is 4·8 mm. to 0·891 mg. when it is 1·2 mm., the temperature being practically constant. These experiments being made on a balance pan refer only to the first instants of the evaporation, when the influence of the distance of the liquid surface from the rim of the vessel would be expected to be greatest, but experiments lasting two hours, made with solutions containing from 100% to 24·25% of sulphuric acid, also give a value for B which, except for the 100% acid, is practically constant, the mean value being 0·701 mg. (depth of surface 3·9 mm.). A similar concordance is observed when the liquid surface is only 0·5 mm. from the vessel's edge, although B has now increased to 0·931 mg.

If, however, the evaporation vessels are surrounded by cylinders 25 cm. high, B is no longer independent of the concentration of the acid, but increases from 0·396 mg. with 73·13% acid to 0·733 mg. with 24·25% acid, and the evaporation is no longer proportional to the fall of tension. This case is shown to be fairly well expressed by the equation $p = B_1(F-f) + B_2(F-f)^2$, the extreme values of B being 0·362 mg. and 0·321 mg., and of B_2, 0·0317 mg. and 0·0288 mg.

E. H.

Apparatus for Fractional Distillation under Reduced Pressure. MARCEL DELÉPINE (*Bull. Soc. chim.*, 1908, [iv], 3, 411).—This is a modification of Brühl's apparatus designed to permit of the separation of the fractions obtained during fractional distillation under reduced pressure without stoppage of the distillation. The receiver is a cylindrical glass vessel, 20 cm. high and 7—8 cm. wide, containing test-tubes arranged vertically round the walls and having near its base an aperture by which it may be exhausted, and provided with a bell-shaped glass cover which fits air-tight to the receiver by means of ground-glass flanges in the usual manner. An adapter ground along part of its length to fit an aperture in the cover of the receiver conveys the distillate from the condenser tube to a test-tube in the receiver, and by rotating the latter a fresh test-tube can at any desired stage in the distillation be brought under the adapter.

T. A. H.

Receiver for Fractional Distillation under Reduced Pressure. HENRI VIGREUX (*Bull. Soc. chim.*, 1908, [iv], 3, 479—481).—The apparatus consists of a short upright condenser, the outer chamber of which serves as a receiver and is provided with (*a*) a side tube connecting it to the distilling flask, (*b*) a side tube by which it can be evacuated, and (*c*) an opening at the base elongated into a tube provided with a stopcock, which gradually widens into a globular receptacle. This receptacle is provided near its upper end with two side stopcocks by means of which communication can be established with the atmosphere or with a pump, and terminates in a third stopcock by which fractions can be drawn off. The apparatus can be used with one or two pumps. With one pump, three fractions can be collected without interrupting the distillation, and with two pumps the operation need not be interrupted until the distillation is completed. The apparatus is figured in the original.

T. A. H.

Internal Energy of Dissolved Substances. A. SCHÜKAREFF (*Zeitsch. physikal. Chem.*, 1908, 62, 601—606).—The author has extended his study of the change of energy exhibited by gaseous-liquid systems in the neighbourhood of the critical temperature (see Abstr., 1903, ii, 710; 1906, ii, 271) to the case of partly miscible liquids in the neighbourhood of the critical solution temperature. Experiments were carried out in which homogeneous mixtures of phenol and water were cooled from temperatures at and above the critical solution temperature (T_c) to the ordinary temperature, and the heat effects determined. In supplementary experiments, the heat liberated in the crystallisation and cooling of pure phenol from 46° to 20° was found to be 39·5 cal. for each gram of phenol. Further, the heat liberated on mixing 1 gram of liquid phenol at 46° with various quantities of water was found to be 8·5 cal.

The internal energy E of dissolved phenol at 20° is estimated as the sum of (1) the heat of separation at $T°$ of a homogeneous solution into pure phenol and water, and (2) the heat liberated in cooling pure phenol from $T°$ to 20°. When E is plotted against concentration, curves are obtained which at temperatures above T_c are concave to the concentration axis. The curvature diminishes as this temperature is approached, until for T_c the curve becomes a straight line. At this temperature, therefore, the heat effect of mixing variously concentrated phenol solutions is zero.

J. C. P.

Condition of Substances in Absolute Sulphuric Acid. ARTHUR HANTZSCH (*Zeitsch. physikal. Chem.*, 1908, 62, 626—630. Compare this vol., ii, 14).—A reply to Oddo and Scandola (this vol., ii, 353). The author criticises the use of hygroscopic substances, like phosphoryl chloride and sulphuryl chloride, in finding the molecular depression of the freezing point for sulphuric acid. It is shown that when perfectly dry pyridine, quinoline, and acridine are taken as solutes, figures are obtained for the molecular weights which are about two-thirds of the normal values. Oddo and Scandola's values for the molecular weights of pyridine and quinoline are too low, on account of the presence of moisture. J. C. P.

Combustion without Flame, and its Application to Lighting with Incandescent Mantles. JEAN MEUNIER (*Compt. rend.*, 1908, **146**, 864—866. Compare this vol., ii, 276).—The author supposes that the temperature of the mantle is very much higher than that of the flame surrounding it. The action of the mantle consists in causing combustion to take place by incandescence as distinguished from combustion by flame, each particle of oxide acting as the centre of such a local combustion. The combustion of a gas in the manner indicated, lowers the inferior limit of inflammability of a gas mixture.
H. M. D.

Calculation of Thermochemical Constants. H. STANLEY REDGROVE (*Chem. News*, 1908, **97**, 183—185. Compare Abstr., 1907, ii, 604).—It is evident from a consideration of the molecular heats of combustion and molecular heats of formation of the hydrocarbons (Abstr., 1907, ii, 929) that, in general, the former are more suitable for the calculation of constants than the latter, and constitute better criteria for the examination of any hypotheses on the subject. It is observed that the effect on the molecular heat of combustion (1) of replacing a hydrogen atom in any hydrocarbon by a chlorine atom is constant; similarly with bromine and iodine; (2) replacing in turn one, two, or three hydrogen atoms in any hydrocarbon by chlorine is constant; (3) the mere position of the halogen has no effect on the molecular heat of combustion. Molecular heats of combustion have been calculated for a number of organic halogen compounds, using the author's "fundamental molecular heat of combustion halogen constant," and are compared with the values found by Thomsen. The molecular heats of formation of the substances have been calculated in a similar manner, and compared with the experimental values.
J. V. E.

Changes in the Viscosity of Liquid Sulphur. LÉON ROTINJANZ (*Zeitsch. physikal. Chem.*, 1908, **62**, 609—621. Compare Smith, Abstr., 1905, ii, 382; Smith, Holmes, and Hall, *ibid.*, 580).—The viscosity of liquid sulphur has been determined at various temperatures. With sulphur, the temperature of which has been raised gradually at the rate of 0·27° to 1·0° per minute, the maximum viscosity (52,000 relatively to water) is found at 187°. If the rate of heating has been greater, the maximum occurs at higher temperatures. With sulphur, the temperature of which has been lowered gradually, the maximum value of the viscosity and the temperature at which it occurs depend on the temperature to which the sulphur has been raised previously. The higher the temperature to which the sulphur has been heated the lower is the maximum value of the viscosity, and the higher is the temperature at which it is found.

Sulphur through which a current of ammonia has been passed has a maximum viscosity of 19,000 at 180°; sulphur containing 0·02% iodine has a maximum viscosity of 5600 at 225°, whilst with a content of 0·77% iodine the maximum viscosity is only 300 at 265°. The relation of the viscosity curve obtained with rising temperature to that obtained with falling temperature is very much the same for these samples of sulphur as for pure sulphur. In the case of sulphur which has been treated with ammonia, there is a break in the falling branch of the viscosity curve at 210°, marked also by a change of colour similar to what is observed in the case of pure sulphur at higher temperatures.

The author draws the conclusion from his experiments that the changes of viscosity exhibited by liquid sulphur are not to be attributed to the presence of amorphous insoluble sulphur.

J. C. P.

Study of the Solutions of Some Salts Exhibiting Negative Viscosity. Frederick H. Getman (*J. Amer. Chem. Soc.*, 1908, **30**, 721—737).—Determinations of the viscosities of some solutions of potassium salts having lower viscosities than that of the solvent (Getman, Abstr., 1907, ii, 517) showed that in every case the viscosity-concentration curve passed through a minimum, and it was suggested that this abnormal behaviour was due to the combined action of the ions and the non-dissociated molecule, the potassium ion appearing to lower the viscosity of the solvent, whilst the anions and non-dissociated molecules tended to increase it. Jones and Veazey (Abstr., 1907, ii, 438) have found that the solutions which diminish the viscosity of water are those which have cations with large atomic volumes.

A study has now been made of the viscosities of aqueous solutions of ammonium chloride, bromide, and nitrate, and rubidium iodide. The results, which are tabulated and plotted as curves, appear to confirm the theory suggested by the author. In accordance with the view of Jones and Veazey, it would be expected, for a series of salts having the same anion, that the lowering of the viscosity would vary directly with the atomic volume of the cation. It is found that rubidium iodide lowers the viscosity to a greater extent than potassium iodide, whilst the lowering produced by ammonium iodide is slightly less than that produced by rubidium iodide.

It was observed that the negative viscosity was in all cases greater at the lower temperatures. This cannot be explained by differences in the degree of dissociation at different temperatures, but it is probable that at the lower temperatures, molecular complexes are formed which, owing to greater volume and smaller surface, cause a diminution in the viscosity (compare Dunstan, Trans., 1904, **85**, 817).

Slotte's empirical formula for calculating viscosities at various temperatures has been found applicable to the solutions studied between 15° and 20°. On Wiedemann's theory that the migration velocity varies inversely with the viscosity for a fixed potential gradient, the product of viscosity and conductivity should be a constant. This relation has been found to be only approximately true for the solutions investigated.

E. G.

The Internal Friction of Colloidal Solutions. H. W. Woudstra (*Chem. Weekblad*, 1908, **5**, 303—312).—I. *The Internal*

Friction of Colloidal Silver Solution.—The viscosity has not a constant value, but diminishes with lapse of time. The presence of metallic salts diminishes the viscosity, the effect of salts of multivalent metals being greater than that of salts of univalent metals.

A. J. W.

Osmotic Pressure of Concentrated Solutions, and the Laws of the Perfect Solution. Gilbert N. Lewis (*J. Amer. Chem. Soc.*, 1908, **30**, 668—687).—The simple laws which are applicable to infinitely dilute solutions are not valid in the case of solutions of finite concentration, Raoult's law being the only one which ever holds in concentrated solutions. This law is re-stated as follows: "At constant pressure and temperature, the activity of the solvent in a perfect solution is proportional to its mol. fraction" (the number of mols. of solvent in one mol. altogether of solvent and solute). Several solutions are mentioned which behave as perfect solutions over the whole range of concentrations from 0% to 100% solute.

The indirect methods of determining osmotic pressure are discussed, and an exact relation between the osmotic pressure and the depression of the f. p. of an aqueous solution is given. It is also shown that the osmotic pressure at one temperature may be obtained from that at any other when the heat of dilution is known, and that, by the aid of thermodynamics alone, an equation can be obtained connecting the osmotic pressure and the concentration of a perfect solution which permits the exact calculation of osmotic pressures in perfect solutions up to 100 atmospheres. In comparatively dilute solutions, the pressures thus obtained are practically identical with those given by van't Hoff's equation as modified by Morse and Frazer, but at high concentrations the divergence is very great. An exact form is given for the mass law in concentrated perfect solutions.

E. G.

Apparatus for [the Study of] Diffusion in Solid Media. Michel Yégounoff (*Arch. sci. phys. nat.*, 1908, [iv], **25**, 350—359).—Several pieces of apparatus which the author has used in the investigation of the rate of diffusion of substances in gelatin are described.

H. M. D.

Apparatus for Continuous Dialysis. Samuel B. Schryver (*Proc. physiol. Soc.*, 1908, xxiii—xxiv.; *J. Physiol.*, **37**).—This is essentially a modification of the Soxhlet apparatus, for continuous dialysis against distilled water or other liquids. Chiffon soaked in colloidin is used for the membrane.

W. D. H.

Conditions of Possibility of Certain Reactions Forming Monovariant Systems. Camille Matignon (*Ann. Chim. Phys.*, 1908, [viii], **14**, 5—125).—After summarising the work of previous investigators in this field, the author proceeds to discuss in fuller detail the proposition relating to variation of entropy in monovariant systems undergoing dissociation which he has enunciated in former communications (compare Abstr., 1899, ii, 273; 1905, ii, 235).

Dealing with over fifty illustrative examples, the law is shown to hold true in the following cases: (1) in monovariant systems containing any number of solids, as, for example, $Na_2SO_{4\,sol.} + HCl_{gas} \rightleftarrows NaHSO_{4\,sol.} + NaCl_{sol.} + Q$ cal.; (2) in systems which yield several gases on dissociation, for example, $NH_{3\,gas} + H_2S_{gas} \rightleftarrows NH_4HS_{sol.} + Q$ cal.; (3) systems containing a gas and a liquid, one in the initial, the other in the final, stage, that is, systems conforming to the general type $A_{gas} + B_{sol.} + \ldots + C_{sol.} \rightleftarrows A'_{liq.} + B'_{sol.} + \ldots + C'_{sol.}$; (4) systems dissociating into both liquid and gas, conforming to the type $A_{gas} + B_{liq.} + C_{sol.} + \ldots + D_{sol.} \rightleftarrows A'_{sol.} + B'_{sol.} + \ldots + D'_{sol.}$. W. O. W.

Deduction of Gibb's Phase Rule. Joseph A. Muller (*Compt. rend.*, 1908, **146**, 866—867).—A simple method of deducing the relationship between the number of substances and phases of a system in equilibrium is given in which thermodynamical considerations are not involved. H. M. D.

[Vapour Pressure of Dry and of Ordinary Sal Ammoniac.] Richard Abegg (*Zeitsch. physikal. Chem.*, 1908, **62**, 607—608. Compare this vol., ii, 157; also Johnson, *ibid.*).—The author maintains, in opposition to van Laar (this vol., ii, 353), that the theory of heterogeneous equilibrium is applicable to the vaporisation of dry ammonium chloride, since the equilibrium can be reached from both sides. Two suggestions are made by way of explanation: (1) the heat of formation of undissociated gaseous ammonium chloride from solid ammonium chloride may be equal to the heat of dissociation of gaseous ammonium chloride into ammonia and hydrogen chloride, or (2) the molecular weights of the products of vaporisation of sal ammoniac may not be the same in the moist and the dry states. J. C. P.

Two New Methods for the Determination of the Secondary Ionisation Constants of Dibasic Acids. Herbert N. McCoy (*J. Amer. Chem. Soc.*, 1908, **30**, 688—694).—The ionisation of a dibasic acid, H_2X, takes place in the two following stages: (1) $H\cdot HX = k_1H_2X$; (2) $H\cdot X = k_2HX$, where k_1 and k_2 are the ionisation constants, and the formulæ represent the molar or ionic concentrations of the corresponding substances. The state of equilibrium is found by combining these two equations, which gives $HX^2/H_2X\cdot X = k_1/k_2$. The author has shown previously (Abstr., 1903, ii, 413) that the equilibrium in solution of the sodium carbonates is accurately represented thus: $NaHCO_3{}^2/H_2CO_3 \times Na_2CO_3 =$ a constant. For a fixed concentration of total sodium, a good constant was found for all proportions of carbonate, hydrogen carbonate, and carbonic acid. The same principle may be applied to the study of solutions of salts of all the non-volatile acids, provided that they are sufficiently soluble in water and in some inert solvent which is immiscible with water. The aqueous solution is shaken, until equilibrium is reached, with a solvent in which the acid is soluble, but the salts insoluble. The concentration of the non-ionised free acid in the aqueous layer is directly proportional to the concentration of the same substance in the immiscible solvent, the proportionality factor being the partition coefficient of the free acid alone, for the two solvents. A simple analysis of the aqueous solution gives the remaining data for the calculation of the concentrations HX and X. Experiments on these lines have been carried out with succinic acid and its sodium salts.

A method is described for the calculation of the secondary ionisation constant, k_2, of a dibasic acid from the conductivities of dilute solutions of the acid and neutral sodium salts. E. G.

Ionisation Constants of the Secondary Hydrogen Ion of Dibasic Acids. E. E. CHANDLER (*J. Amer. Chem. Soc.*, 1908, 30, 694—713).—The methods described by McCoy (preceding abstract) for determining the secondary ionisation constants of dibasic acids, and applied by him to the sodium salts of succinic acids, have been extended to the salts of oxalic, malonic, pimelic, glutaric, suberic, azelaic, sebacic, phthalic, *iso*phthalic, camphoric, itaconic, maleic, fumaric, and mono- and di-bromosuccinic acids. Determinations have been made of the partition coefficients of the acids between water and ether, the equilibrium constants, and the conductivities of the salt solutions. The results are tabulated.

With regard to the partition experiments, the degree of ionisation, a, of an acid was calculated from the primary ionisation constant, k_1, by means of the equation $a^2/(1-a)V=k_1$. The results are expressed as p, the ratio of the concentration of an aqueous solution of the acid to that of the corresponding ethereal solution, and as P, the true partition coefficient, the ratio of the concentration of the non-ionised acid in the two solvents. In the case of oxalic acid, the value of p varies very greatly with the concentration, whilst the value of P is constant within the limits of experimental error. In its change of ionisation with concentration, oxalic acid does not follow exactly Ostwald's dilution law, and in this respect resembles salts and the strong acids and bases.

It has been found that for constant concentrations of the total base, the value of k_1/k_2 is independent of the ratio of base to acid. The value increases, however, with decreasing concentration of the total base. The constant k_1/k_2 for dibromosuccinic acid does not differ much from that for succinic acid, although both k_1 and k_2 are very much greater, whence it is evident that the substitution of the halogen affects the dissociation of the two hydrogen atoms almost equally.

The determinations of the secondary ionisation constant by the conductivity method led to the conclusion that the conductivities of the HX ions were in all cases approximately equal to those of the corresponding X ions. The values of k_2 found by this method agree closely with those obtained from the partition experiments. E. G.

Equilibrium between Carbon Dioxide, Sodium Hydrogen Carbonate, Monosodium Phosphate, and Disodium Phosphate at Body Temperature. LAWRENCE J. HENDERSON and OTIS F. BLACK. **Theory of Neutrality Regulation in the Animal Organism.** L. J. HENDERSON (*Amer. J. Physiol.*, 1908, 21, 420—426, 427—448).—The first paper deals with solutions, and a method is described for saturating them at constant temperature with carbon dioxide of known tension. In solutions containing the substances mentioned in the title, equilibrium may be defined by the proportion

$$\frac{NaH_2PO_4}{Na_2HPO_4} : \frac{H_2CO_3}{NaHCO_3} = 3{\cdot}3 : 1{\cdot}0.$$

This relationship corresponds with the requirements of the concentration law. These facts serve to define the most important equilibria of neutrality regulation in the aqueous solutions of the body, and the physiological factors involved in this regulation and a theory founded on the observations are discussed in the second paper. W. D. H.

Free Energy of Nickel Chloride. M. DEKAY THOMPSON and M. W. SAGE (*J. Amer. Chem. Soc.*, 1908, **30**, 714—721).—Calculations of the free energy have been made by Thompson (Abstr., 1906, ii, 517) from potential measurements of all compounds for which the necessary data existed.

The free energy, ΔF, of nickel chloride has now been determined by measuring the *E.M.F.* of the cell: nickel | saturated solution of $NiCl_2$ | $Pt + Cl_2$. A formula has been deduced for ΔF involving the potential of this cell and the vapour pressure of the saturated solution of the systems $NiCl_2,6H_2O-NiCl_2,2H_2O$ and $NiCl_2,2H_2O-NiCl_2$, the pressure of the latter system being obtained both by direct and indirect measurement. The value of ΔF was found to be $-74{\cdot}4$ Cal. The free energy and total energy of nickel chloride were found to be approximately equal. E. G.

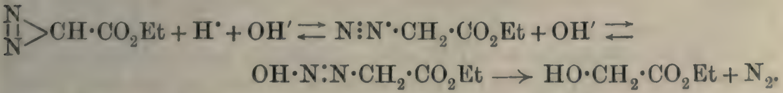
Conditions of Equilibrium in the Systems Ferric Chloride–Potassium Ferrocyanide–Water. V. VOLSCHIN (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 480—485).—The author has studied the formation of insoluble or soluble Prussian blue in aqueous solutions containing ferric chloride and potassium ferrocyanide in varying proportions and concentrations. The concentration of ferric chloride in the initial solution in gram-equivalents per litre is expressed by C, the ratio of the corresponding concentration of the potassium ferrocyanide to C being denoted by k.

When C is constant and has the value 0·06—0·07, variation of the concentration of the ferrocyanide reveals the existence of a "critical" point; mixtures for which k is less than 1 give precipitates, whilst those for which k is greater than 1 appear to be real solutions. Observations of various of these solutions show that, in time, certain of them undergo complete precipitation, the liquid becoming absolutely free from Prussian blue. The time, t, required for this coagulation depends on both C and k; when the former is constant, t increases as k diminishes, and when k is constant, it increases as C diminishes. Investigation of the relation between C and t shows that, when C is sufficiently large, all the mixtures should undergo coagulation, no matter whether k is less or greater than 1. This is confirmed by experiment, for when $C = 0{\cdot}1$ the most stable solution coagulates in a few minutes, whilst when $C = 0{\cdot}2$, all mixtures coagulate rapidly, the more so as the critical point becomes more remote. Hence the conclusion is drawn that no mixture containing

$FeCl_3$, K_4FeCy_6, and H_2O gives a stable solution, and that a soluble Prussian blue (in the ordinary meaning of the term soluble) does not exist. When C is small and k only slightly greater than 1, k may be practically infinite. The value of k corresponding with the critical point is not constant, but increases from 0·9353 to 1·0921 as C is increased from 0·00261 to 0·04828. T. H. P.

Equilibrium in the System: Silver Nitrate and Pyridine. Louis Kahlenberg and Robert K. Brewer (*J. Physical Chem.*, 1908, **12**, 283—289).—The complete solubility curve for silver nitrate in pyridine has been determined from the melting point of the latter to 110°. Pyridine melts at $-48·5°$, and its eutectic point with the compound $AgNO_3,6Py$ is at $-65°$. From $-65°$ to $-24°$, the solution is in equilibrium with the compound $AgNO_3,6Py$, which was not previously known; from $-24°$ to $+48·5°$ with the compound $AgNO_3,3Py$; from 48·5° to 79° with the compound $AgNO_3,2Py$, and above the latter temperature with silver nitrate. The dipyridine compound melts without decomposition at 87°. The di- and tri-pyridine compounds have already been described by Jörgensen (*J. pr. Chem.*, 1886, **33**, 501). G. S.

Kinetics of Ethyl Diazoacetate and the Dilution Law. Otto Mumm (*Zeitsch. physikal. Chem.*, 1908, **62**, 589—600).—The author supposes that as regards decomposition with evolution of nitrogen there is complete analogy between aromatic and aliphatic diazo-compounds, and that the decomposition of ethyl diazoacetate may be represented as follows:



$$\begin{matrix}N\\ \|\\ N\end{matrix}\!\!>CH\cdot CO_2Et + H^{\bullet} + OH' \rightleftharpoons N{\vdots}N^{\bullet}\cdot CH_2\cdot CO_2Et + OH' \rightleftharpoons$$
$$OH\cdot N{:}N\cdot CH_2\cdot CO_2Et \longrightarrow HO\cdot CH_2\cdot CO_2Et + N_2.$$

On this basis, the experimental results obtained by Fraenkel (Abstr., 1907, ii, 746) and by Bredig and Ripley (Abstr., 1907, ii, 941), especially as these bear on the secondary formation of ethyl chloroacetate in presence of hydrochloric acid, are discussed. The following conclusions are deduced: (1) the concentration of the undissociated portion of diazo-chloride is directly proportional to the concentration of the diazo-ion; (2) the concentration of the undissociated portion of diazo-chloride is nearly proportional to the cube root of the concentration of the chlorine ion.

It appears therefore that the experiments carried out by Bredig and his pupils throw light on the question how the concentration of the undissociated part of a strong electrolyte alters when the concentration of one ion only changes. The author thus arrives at the following formulation of the dilution law: $Kc = c_1^{4/3}$, which is similar to those suggested by van't Hoff and by Bancroft (see Abstr., 1900, ii, 186). The fact that in the case of diazo-chloride the concentration of the undissociated portion varies proportionally to the cube root of the anion concentration is interpreted by the assumption that in solution three anions are united to form a complex (compare Morgan and

Kanolt Abstr., 1904, ii, 535). The bearing of such an assumption on the behaviour of strong electrolytes generally is discussed.

J. C. P.

Physicochemical Investigation of Amylase and Maltase. Mlle. Ch. Philoche (*J. Chim. phys.*, 1908, 6, 212—293).—The action of maltase on maltose, and of amylase (diastase) on starch and on glycogen, has been systematically investigated, but the present paper only contains part of the results obtained with the latter enzyme.

Maltase and Maltose (compare Terroine, Abstr., 1904, ii, 317).—Maltase from Taka-diastase (Merck) was allowed to act on maltose at 39° and 40° in various dilutions, and the reaction was followed mainly with the polarimeter. The question of the stability of the enzyme and of the influence of the products of reaction on the velocity has already been discussed (Abstr., 1904, i, 839; ii, 318). The velocity of the reaction is proportional to the enzyme concentration, but when more than 2% of maltose is present, it is independent of the concentration of the latter. The initial velocity, v, for different maltose concentrations is represented satisfactorily by the formula $v = Ka/(1 + ma)$, where a is the maltose concentration, and K and m are constants. As regards the whole course of the reaction, the velocity is greater than the logarithmic law would indicate, but is represented satisfactorily by the empirical formula $2K_1 = 1/t\log(a + x)/(a - x)$ (where x/a is the proportion of maltose decomposed at the time t), which also holds for the hydrolysis of sucrose by invertin (Henri, Abstr., 1902, ii, 127).

Amylase on Starch and Glycogen (compare Brown and Glendinning, Trans., 1902, **81**, 388).—Three specimens of amylase from Taka-diastase, from "absolute diastase" (Merck) obtained from malt, and from pancreatic juice respectively were employed. These were allowed to act on soluble starch at 31·5°, and at definite intervals part of the mixture was removed, the reaction stopped by adding hot water, and the maltose estimated by Fehling's solution.

Up to 2½% of starch, the velocity of the reaction depends on the starch concentration, but for solutions containing more than the above proportion of starch the rate is independent of the concentration of the latter. On the other hand, the rate of appearance of maltose increases with the glycogen concentration at least up to 5% of the latter.

When the concentration of the substance acted on is constant, the rate of formation of maltose increases less rapidly than the concentration of amylase, both for the hydrolysis of starch and glycogen. In the case of starch, the velocity is represented by the linear equation $x = Bc - Ac^2$, where c is the concentration of the diastase and x the quantity of maltose formed, and A and B are constants, but in glycogen solutions, the relation appears to be more complicated. G. S.

Relation between Rotatory Power and Chemical Constitution. D. Hardin and S. Sikorsky (*J. Chim. phys.*, 1908, 6, 179—211).—A number of amyl derivatives have been prepared, and the specific rotations determined at intervals of 10° to 15° from the ordinary temperature to within a few degrees of the respective boiling points. The data thus obtained are employed to test certain theoretical deductions as to the relation between rotatory power and chemical constitution.

It is assumed that in the cases dealt with, the centres of gravity of the side chains lie on the axes of the asymmetric carbon atom at different distances from it, and that the distances of the atoms in a molecule depend only on their nature and not on their arrangement. The formula connecting the product of asymmetry (Guye) and the angle of rotation, deduced on the above assumptions, contains only one unknown quantity, *c*, which is a function of the distance between the carbon atoms. From the experimental data, it is shown that for the simplest amyl derivatives containing not more than four atoms of carbon, *c* has the same numerical value, but the arrangement of the atoms in the group C_5H_{11} and higher groups must be different from that generally assumed. It is further shown that the product of the distance between an atom of a given element and an atom of carbon by the atomic weight of the element depends on the position of the latter in the periodic table, and on certain constants referring to carbon chains. For certain other deductions, more particularly as to the sign of the rotation, the original paper should be consulted.

The amyl derivatives examined were prepared from *l*-amyl alcohol (Kahlbaum), but, as the latter contained only 95% of the pure compound, the products were not quite pure. For γ-methylhexane (Marckwald, Abstr., 1904, i, 362). $[\alpha]_D$ varies only very little between 15° and 85°. βε-Dimethylheptane (Guye and Amaral, Abstr., 1895, ii, 472) has D^{16} 0·7154, $[\alpha]_D^{16}$ + 9·48°, D^{125} 0·6334, $[\alpha]_D^{125}$ + 8·71° n_D^4 1·40713. γ-Methyloctane was prepared by the action of metallic sodium on a mixture of *n*-butyl iodide and amyl iodide and repeated fractionation. The fraction boiling at 142·4—143·4 has D^{17} 0·7206, $[\alpha]_D^{17}$ + 9·38°, D^{140} 0·6192, $[\alpha]_D^{140}$ + 8·48°, n_D^4 1·4092. Di*iso*amyl (Guye and Amaral, *loc. cit.*) was prepared by fractionation from the higher boiling portion of the mixture of hydrocarbons obtained as above. The fraction boiling at 159·8—160·8° has D^{13} 0·7348, $[\alpha]_D^{13}$ + 16·85°, $D^{145\cdot5}$ 0·6343, $[\alpha]_D^{145\cdot5}$ + 16·32°. Active amyl chloride (β-methylbutyl chloride), b. p. 97·6—99°, has $D^{17\cdot5}$ 0·8812, $[\alpha]^{17\cdot5}$ + 1·38°, D^{94} 0·8055, $[\alpha]_D^{94}$ + 0·86°; the bromide, b. p. 121—121·4°, has $D^{31\cdot5}$ 1·2072, $[\alpha]_D^{31\cdot5}$ + 3·69°, D^{115} 1·0973, $[\alpha]_D^{115}$ + 2·71°. For the corresponding amyl amine, $[\alpha]_D$ (– 5·86°, according to Marckwald, *loc. cit.*) scarcely alters between 18° and 85°; the acetate, b. p. 141·2—142°, has $D^{12\cdot5}$ 0·8803, $[\alpha]_D^{12\cdot5}$ + 3·35°, D^{135} 0·7609, $[\alpha]_D^{135}$ + 3·36°; the mercaptan, $C_5H_{11}{\cdot}SH$, b. p. 117·4—117·6°, has D^{13} 0·8483, $[\alpha]_D^{13}$ + 3·49°, D^{117} 0·7565, $[\alpha]_D^{117}$ + 2·04°. The acetal, $CHMe(OC_5H_{11})_2$, was prepared by passing hydrogen chloride into a mixture of acetaldehyde and active amyl alcohol at 0° and allowing it to remain at 0° for twenty-four hours. The fraction boiling at 207—209° has D^{21} 0·8255, $[\alpha]_D^{21}$ + 1·55°. D^{200} 0·6712, $[\alpha]_D^{200}$ + 3·50°; the cyanide (β-methylbutyronitrile), b. p. 151·4—152·6°/743 mm., has D^{10} 0·8395, $[\alpha]_D^{10}$ + 7·22°, D^{145} 0·7272, $[\alpha]_D^{145}$ + 6·29° at 145°. β-Methylbutyric acid, prepared by hydrolysis of the nitrile, has b. p. 197·4—198°, D^{75} 0·8866, $[\alpha]_D^{75}$ + 6·43°, D^{149} 0·7178, $[\alpha]_D^{149}$ + 5·22°. The *methyl* ester has b. p. 141—142°, $D^{6\cdot5}$ 0·8885, $[\alpha]_D^{6\cdot5}$ + 6·97°, D^{137} 0·7727, $[\alpha]_D^{137}$ + 5·22°.

G. S.

Catalysis. III. The Theories of Esterification and Saponification. Julius Stieglitz (*Amer. Chem. J.*, 1908, **39**, 402—431).—Polemical. A reply to Acree (this vol., ii, 169).
R. J. C.

Catalysis. VIII. Theories of Catalysis. Salomon F. Acree (*Amer. Chem. J.*, 1908, **39**, 513—527).—Polemical. A reply to Stieglitz (preceding abstract).
E. G.

Pulsating Catalysis of Hydrogen Peroxide by Mercury. I—III. A. von Antropoff (*Zeitsch. physikal. Chem.*, 1908, **62**, 513—588).—A continuation of earlier work on this subject (see Bredig and Weinmayr, Abstr., 1903, ii, 279; Bredig and Wilke, Abstr., 1905, ii, 151).—The periodic changes in the rate of gas evolution and in the potential difference at the electrode Hg | H_2O_2 have been recorded simultaneously by self-registering apparatus (compare Ostwald, Abstr., 1901, ii, 24; Brauer, *ibid.*, 635). A large number of the curves obtained are appended to the paper, and these are discussed in detail, more especially in reference to the effect of various dissolved substances on the character of the reaction.

The potential difference of the calomel electrode being taken as −0·56 volt, the potential difference for Hg | H_2O_2 was found in different experiments to lie between −0·73 and −0·84 for the active condition, and between −0·84 and −0·97 for the inactive condition. Addition of alkali makes the potential of the solution more negative, whilst the addition of acid has the opposite effect.

The changes taking place at the mercury surface have been observed under the microscope, and it is found that the catalysis occurs only in the presence of the surface film referred to in the earlier paper (*loc. cit.*). The evolution of oxygen occurs only at the edges of this film, the periodic disappearances of which are due to its dissolution. For the initiation of the active stage in the pulsating reaction, a rupture of the surface film is necessary.

A closer study of the recorded curves shows that the rate of oxygen evolution is approximately proportional to the length of the boundary between the film and the bright mercury surface, whilst the potential rises and falls proportionally to the extent of the bright mercury surface.

The author regards the film as due to the formation of a precipitate (probably mercurous peroxide) after sufficient mercury ions have gone into solution. The film once formed is ruptured mechanically, and its subsequent dissolution is due to local electrical currents produced at the boundary between film and bright mercury surface. The pulsating catalysis of hydrogen peroxide by mercury is accordingly described as an intermittent electrolysis of hydrogen peroxide.
J. C. P.

Catalytic Reactions at High Temperatures and Pressures. XXI. The Decomposition of Alcohols in Presence of Metallic Oxides. Wladimir N. Ipatieff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 508—513. Compare this vol., ii, 266).—The author has studied the catalytic decomposition of *iso*butyl alcohol by Cr_2O_3, MnO_2, Ni_2O_3,

Cu_2O, ZnO, SnO, SnO_2, UO_2, and Ag_2O, the resulting products being compared with those obtained by using the corresponding metals as catalysts.

If a metal acts as a catalyst in the aldehydic decomposition of alcohols, its oxide generally exhibits the same property, even although it is incapable of undergoing complete reduction to metal. Thus zinc oxide acts as an excellent catalyst in this reaction, although it is not appreciably reduced. It may be that intermediate reduction of zinc oxide and oxidation of the reduced product take place to an inappreciable extent, as a small quantity of zinc oxide is always formed during the catalysis of alcohol by metallic zinc. The conclusion is drawn that water and metallic oxide play a part in these catalytic decompositions of alcohol.

The effectiveness of the metals and their oxides as catalysts is related to the position of the metals in the periodic system of the elements. Arrangement of the metals in the order of the amounts of aldehyde formed in their action on alcohol gives the series: chromium, manganese, iron, cobalt, nickel, copper, zinc; chromium yields the least, and zinc the most, aldehyde. The capacity of manganese, iron, cobalt, and nickel for decomposing the aldehyde formed into hydrocarbon and carbon monoxide increases in the order in which these metals occur in the periodic arrangement of the elements. Metals having high atomic weights and their oxides produce a two-fold decomposition of alcohols, namely, into aldehydes and into ethylene hydrocarbons. The best metallic catalyst for the production of aldehydes and ketones from alcohols is zinc, the catalytic properties of which are not impaired by the passage of the alcohol through it. On the other hand, the catalytic activity of reduced copper, which never gives rise to such a high yield of aldehyde as does zinc, becomes gradually weakened.

The best catalysts for preparing ethylene hydrocarbons are alumina and kaolin.

When alcohol vapour is passed through magnesium oxide or barium oxide heated at 450—500°, no catalytic decomposition of the alcohol occurs.

The work of Senderens (Abstr., 1907, i, 577) is discussed.

T. H. P.

Theory of Solutions. OSCAR SCARPA (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 362—369).—The author's experiments were made with a view to confirming van't Hoff's law stating that the temperature-coefficients of the pressure of a gas and of the osmotic pressure of a dissolved substance are numerically identical.

Two communicating vessels containing a salt solution were maintained at different constant temperatures until a condition of osmotic equilibrium had been attained, after which the concentrations of the salt in the two vessels were determined. Three different solutions were employed, one of sodium chloride, and two, of different concentrations, of potassium chloride. The results were, in all cases, found to be in satisfactory agreement with the equation: $\Theta/T = \gamma_2\{1 + \alpha(\Theta - T)\}(1 + a_2)/\gamma_1(1 + a_1)$, where Θ and T are the temperatures of the two vessels, a the coefficient of thermal expansion of the solution, γ_1 and γ_2 the molecular concentrations, and α_1 and α_2 the degrees of dissociation of the salt in the two solutions. The observations are hence in accord with van't Hoff's law. T. H. P.

The Effect of One Salt on the Hydrating Power of Another Salt Present in the Same Solution. XX. Harry C. Jones and Charles M. Stine (*Amer. Chem. J.*, 1908, **39**, 313—402. Compare this vol., ii, 19).—When two salts which form solution hydrates are dissolved together in water, each will diminish the extent to which the other becomes hydrated. The authors have endeavoured to estimate the amount of this mutual interference of two salts by measurements of the conductivity and freezing points of the mixed solutions.

The pairs of salts studied always contained an ion in common, so that the retrogression of the degree of ionisation of the salts due to the presence of each other could be roughly estimated by assuming a simple mass action relation to exist between the salts and their ions. The disturbing effect of the varying amounts of combined water on this equilibrium was neglected. The viscosity of the mixtures differing considerably from that of the unmixed solutions, and the aqueous atmosphere about each ion being smaller in the mixed solutions, the resistance to ionic motion must also be different in the mixtures. The authors recognise that the conductivity of their concentrated solutions is not an accurate measure of the dissociation on account of these complications, and their theoretical deductions are somewhat vitiated thereby.

Measurements made on potassium chloride solutions lead to the conclusion that this salt is not hydrated (compare, however, Biltz, Abstr., 1904, ii, 710; Caldwell, Abstr., 1907, ii, 14; Philip, Trans., 1907, **91**, 711; Bousfield, Abstr., 1905, ii, 369). On the other hand, the experimental values are not in accord with the assumption that potassium chloride is also without influence on the hydration of calcium chloride. A formula is devised to calculate the degree of hydration of calcium chloride in presence of potassium chloride. The values obtained by this means are from 2 to 4 molecules of water less than those deduced from measurements with pure calcium chloride solutions. This effect is attributed to the fact that volume-normal solutions were employed, so that there is somewhat less water per equivalent of calcium chloride in those solutions which also contain potassium chloride.

Measurements were made with the following pairs of salts: $CaCl_2$—$MgCl_2$, $SrCl_2$—$CaCl_2$, $Mg(NO_3)_2$—$Sr(NO_3)_2$, LiBr—NaBr, $Ca(NO_3)_2$—$Mg(NO_3)_2$, $AlCl_3$—$FeCl_3$, $Ca(NO_3)_2$—$CaCl_2$. The lowering of the freezing point by the mixed salts is always less than the sum of the depressions in the single solutions. It is pointed out that the hydration of each salt is necessarily diminished by the presence of the other, for otherwise some of the concentrated mixtures would contain no free water at all.

The method employed by the authors to calculate the degree of hydration of each salt in the mixture is based on the assumption that in the competition for water each salt loses a part which is inversely proportional to its total water of hydration. The values obtained are of the nature expected, namely, that the hydration of each salt is in general somewhat diminished by the other. Deviations from this behaviour are explained by the hypothesis that the molecules of some salts may have greater hydrating power than the ions. That is, in these cases retrogression of the ionisation might lead to increase in the degree of hydration.

The diminution in molecular conductivity when solutions of potassium and ammonium chlorides are mixed is much greater at 25° than at 0°. This is contrary to expectation on the simple ionic dissociation hypothesis. The authors claim that it proves that conductivity does not give an accurate measure of the degree of ionisation of salts even when they may be supposed to be anhydrous in solution. R. J. C.

Rate of Growth and Solution of Crystals. IWAN IW. ANDRÉEFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 397—444. Compare Abstr., 1907, ii, 336).—The results of the author's investigations lead to the following conclusions.

The rate of growth and of solution of a crystal face is given by the expression $dx/dt = kF(C - c)$, where dx/dt is the quantity of substance deposited on, or dissolved from the face in unit time, F the area of the face, C the concentration of the supersaturated or unsaturated solution, c the concentration of a solution saturated with respect to the particular face considered, and k a constant independent of the nature of the face. The relative rate of growth of any two faces varies with the concentration. In highly supersaturated solutions, the faces grow at nearly the same rate, but differences in the rates of growth appear as the solution approaches the state of saturation. By continued dilution of the solution, a point may be attained at which one face begins to dissolve, whilst another continues to grow. When etched faces appear, owing to variations in the solubility of the crystal in different directions, different faces assume almost the same rate of solution. As crystals continue to grow, the most readily soluble faces disappear, owing to the more rapid growth of the other faces.

T. H. P.

Helical Structures. PAUL GAUBERT (*Compt. rend.*, 1908, **146**, 829—831. Compare Abstr., 1907, ii, 939).—When a layer of fused cholesterol, pressed between a microscopic slide and cover-glass, is repeatedly allowed to solidify and remelted, it crystallises entirely in spherolites. The latter consists of two kinds, in the first the crystalline particles possessing the same optical orientation are arranged in concentric rings, and the scrolls, habitually left-handed, are formed round the obtuse bisectrix parallel to the direction of the fibres, whilst in the second, the helical scrolls are similar, but the crystalline particles having the same orientation are arranged in the form of a spiral (a photomicrograph of this is reproduced in the paper), usually left-, but sometimes right-handed.

Since samples of cholesterol from different sources differ in the readiness with which they give spherolites having helical scrolls, the author suggests that the origin of the latter is to be explained by the presence of foreign substances in these cholesterols in varying quantities or of diverse kinds. This view is supported by Jaeger's failure to obtain spherolites from cholesterol, whilst obtaining them easily with phytosterol.

Cholesterol melted with santonin gives a product which also forms spherolites having helical scrolls, and the greater the velocity of the formation of the spherolites, that is, the nearer the temperature is to the m. p., the greater is the pitch of the helix. The latter also depends on the proportion of santonin (compare Wallerant, Abstr., 1906, ii, 838). E. H.

Colloids and their Adsorption Compounds. Wilhelm Biltz (*Chem. Zentr.*, 1908. i, 915; from *Med.-naturwiss. Arch.*, 1907, 1, 267—299).—The author briefly sketches the preparation, structure, behaviour, and the adsorptive powers of colloids, and treats of the process of dyeing: also the purification of sewage and the retention of albumins. J. V. E.

Gelatose as Colloid Producer. Raphael E. Liesegang (*Zeitsch. Chem. Ind. Kolloide*, 1908, 2, 307).—The addition of gelatose to a jelly of gelatin containing dissolved potassium dichromate prevents the crystallisation of the salt on drying (compare Abstr., 1906, ii, 273). Further, when a solution of 20 grams of gelatin in 100 grams of water is boiled for several days (gelatose being thus produced), ice no longer separates, even on prolonged exposure to a temperature of $-10°$. G. S.

The Process of Gelatinisation. S. A. Levites (*Chem. Zentr.*, 1908, i, 700—701; from *Zeitsch. Chem. Ind. Kolloide*, 1907, 2, 161—170, 208—215. Compare this vol., ii, 161).—*Velocity of Gelatinisation.*—A minimum coagulation concentration for glutin is found to be 0·25 gram in 100 c.c. of water at 0°; for δ-galactan, 0·1—0·15 gram. From results obtained, the author deduces the general rule that aqueous solutions of salts of monobasic acids, except alkali formates and acetates, retard the coagulation of gelatin; salts of di- and tri-basic acids, polyhydric alcohols, and sugars increase the rate of coagulation; monohydric alcohols retard the process more as their molecular weight increases.

Agar-agar coagulation is hastened by the presence of chlorides, bromides, cyanides, formates, acetates, and salts of polybasic acids; salts of the remaining monobasic acids retard coagulation. The velocity of coagulation is dependent on the solubility of the colloid; the greater the solubility the more slowly gelatinisation proceeds. Only the introduction of substances which alter the solubility has any influence on the coagulation, a decrease of solubility increasing the rate of coagulation. A mixed solution of gelatin and agar-agar, although depositing a small quantity of agar-agar at first, gelatinises as a whole, the velocity being nearly equal to the mean of the coagulation velocities of the two components.

J. V. E.

Inclusion of Soluble Substances by Certain Precipitates. PAUL FRION (*Compt. rend.*, 1908, **146**, 925—926).—Measurements of the quantities of lanthanum and magnesium contained in barium sulphate which has been precipitated from solutions containing a salt of one of these metals show that the amount of included soluble substance is greater when the precipitation takes place in a basic than in neutral solution, and much greater in a neutral than in an acid solution; that it increases with the concentration and with the valency of the included ion, and also with the dilution of the original solution. Assuming that the precipitate consists of granules electrically charged by contact with +H or −OH ions (compare Perrin, Abstr., 1904, ii, 8; 1905, ii, 138), this charge is diminished by the presence of oppositely charged multivalent ions. M. A. W.

Principle of Evolution in Chemistry. BASIL B. KURILOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 471—476. Compare Abstr., 1906, ii, 343, 349).—The author discusses the gradual change of properties exhibited by successive elements in a group of the periodic system, and supposes that similar gradual changes are to be met with, not only among what are termed definite chemical compounds, but also in any class of natural or artificial substances. Basic compounds (*loc. cit.*) are discussed in this connexion.

T. H. P.

Indestructibility of Matter and the Absence of Exact Relations Among the Atomic Weights. DANIEL F. COMSTOCK (*J. Amer. Chem. Soc.*, 1908, **30**, 683—688).—According to the electrical theory of matter, the mass of a piece of matter is determined solely by, and is proportional to, the amount of electromagnetic energy which it contains. It follows that inertia or mass is really a property of the energy stored up in the structure which defines the space relations of a piece of matter and is not a property of the structure itself. Hence the law of the conservation of mass, which there is reason to believe is only approximate, is in reality a corollary to the law of the conservation of energy, and thus the latter law is closely related to the "indestructibility of matter."

It therefore follows than any loss of energy must involve a decrease in mass, and hence a decrease in weight. Thus when a chemical action takes place in which heat is developed, when a substance is cooled, or when by a process of radioactivity a substance loses energy and is transformed into another substance, a loss in weight must occur. In the first two cases, the change is too small to be detected, but in the last case the change should be appreciable and affords an explanation of the irregularities which occur in the table of atomic weights.

It is pointed out that, since gravity is proportional to mass,

gravitation must be considered as acting between quantities of confined energy and not between masses in any other sense.
E. G.

The Atomic Hypothesis and the Energetic Theory of the Universe. Leo Pissarjewsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 444—451).—A discussion of the views of Ostwald and others regarding the constitution of matter.
T. H. P.

Energy of the Elements. Nikolai N. Beketoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 451—457).—A discursive paper containing no new results.
T. H. P.

New Conception of the Element. Aldo Mieli (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 374—378, 420—424).—The author criticises previous definitions of an element, which he defines as follows. He considers a given system of substances and a given field of physical conditions. The components of the system, in the sense of the phase rule, are found, and by considering these in any sub-system, and under any sub-field of conditions, the components of these components are then obtained. By repetition of this process, a group of components is obtained ultimately which are incapable of further decomposition, and which are the elements of the given system in the given field. The advantages of this definition are discussed.
T. H. P.

Electron Theory and Valency. Hugo Kauffmann (*Physikal. Zeitsch.*, 1908, **9**, 311—314. Compare Stark, this vol., ii, 138).—A theoretical paper dealing with the conception of valency from the standpoint of the electron theory. The greater reactivity of unsaturated carbon compounds compared with the corresponding saturated compounds is explainable by the greater spacial extension of the electric fields which are associated with the electrons, each one of which corresponds with a valency unit.

The idea of partial valencies, as put forward by Thiele, is a direct consequence of the electronic conception of valency. The author interprets Thiele's benzene formula in terms of the electron theory, and discusses the possibility of the greater freedom of electrons which are associated with more than two atoms in giving rise to fluorescence phenomena.
H. M. D.

New Views on Chemical Processes. Franz Wald (*Chem. Zentr.*, 1908, i, 914; from *Oesterr. Chem. Zeit.*, 1908, **11**, 50—51).—The possibility of treating experimental facts in a manner free from any hypothesis, and based on thermodynamic principles, is discussed.
J. V. E.

New Reflux Condenser for Extraction Apparatus. Eduard Merkel (*Zeitsch. angew. Chem.*, 1908, **21**, 976).—A pear-shaped form of Liebig condenser is described, which enters some way into the extraction apparatus and is found effective.
J. V. E.

Cylinder for Micro-hydrometers. A. Gawalowski (*Zeitsch. anal. Chem.*, 1908, **47**, 306).—A cylinder for use with tube-shaped micro-hydrometers is described. It consists of a thick-walled piece of glass tubing from 1 to 1·25 cm. in diameter; the lower end is closed by a glass stopper, which is ground into the tube and serves as a foot for the apparatus. As the cylinder holds only about 15 c.c. of liquid, it is useful for taking the density of small quantities of urine, serum, &c. W. P. S.

Constant Head of Water for Laboratories. Henri Muraour (*Chem. Zentr.*, 1908, i, 1017; from *Rev. gén. Chemie*, 1907, **10**, 359—360).—A simple arrangement is described for maintaining a constant head of water by running the feed-water into a small auxiliary reservoir connected by a siphon to the main tank. The small reservoir may be adjusted to any height, and the excess of feed-water is carried away from it by a side tube. J. V. E.

Inorganic Chemistry.

Temperatures of Maximum Density of Aqueous Hydrogen Chloride Solutions and the Expansion of the Latter on Heating. N. A. Schernay (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 518—536).—The author has measured (1) the temperatures of maximum density; (2) the expansion and (3) the freezing points of solutions of hydrogen chloride of different concentrations, and has examined the manner in which these magnitudes vary with the amount of hydrogen chloride in the solution.

The following values of D_4^{15} were obtained by the author, the numbers in brackets being those calculated from Mendeléeff's formula: 0·41 gram-mol. HCl per 1000 grams of water, 1·00616 (1·00654); 0·94, 1·01533 (1·01552); 1·71, 1·02807 (1·02837); 2·01, 1·03237 (1·03288); 2·99, 1·04759 (1·04823).

The coefficients of expansion at 20° are as follows: $HCl + 139H_2O$, 0·00021; $HCl + 100H_2O$, 0·00022 (Marignac); $HCl + 59H_2O$, 0·00023; $HCl + 50H_2O$, 0·00024 (Marignac); $HCl + 32{\cdot}5H_2O$, 0·00025; $HCl + 28H_2O$, 0·00025; $HCl + 25H_2O$, 0·00028 (Marignac).

In the following table, *M* represents the number of gram-mols. of HCl per 1000 grams H_2O, *T* the temperature of maximum density, and *D* the depression of the temperature of maximum density of water by the hydrogen chloride:

M.	*T.*	*D.*	*D/M.*	*(D+7)/M.*
0·41	+1·19°	2·81°	6·85	24·00
0·94	−2·16	6·16	6·54	14·00
1·71	−10·64	14·64	8·56	12·65
2·01	−14·45	18·45	9·17	12·66
2·99	−26·25	30·25	10·11	11·70

The approximate equality of the first two values of D/M and of the last three values of $(D+7)/M$ shows that the relation between the amount of hydrogen chloride present and the depression of the temperature of maximum density caused by it is represented by two intersecting straight lines. A similar result was obtained by Depretz (*Ann. Chim. Phys.*, 1893) for solutions of calcium chloride.

Determinations of the freezing points (t) of hydrogen chloride solutions give values the relationship of which to the concentration is expressed by two straight lines. For values of M up to 1·26, the ratio t/M has the value $-3·9$, whilst for higher values this ratio gradually increases up to $-5·27$ for $M = 2·99$; for values of M from about 1·3 to 2·99, the ratio $(t+2)/M$ has a constant value of about $-5·6$. T. H. P.

Apparatus for Demonstrating the Synthesis of Water. Richard Kempf (*Chem. Zentr.*, 1908, i, 704; from *Zeitsch. phys.-chem. Unter.*, 1908, **21**, 35—37).—Around the point of a water-cooled, funnel-shaped copper vessel a number of gas flames are arranged so that the condensed water runs to the point and drops into a receiver. The carbon dioxide produced can be collected from under a deep rim situated on the top edge of the copper vessel. J. V. E.

Formation of Hydrogen Peroxide by the Silent Electric Discharge. Walther Löb (*Ber.*, 1908, **41**, 1517—1518. Compare Fischer and Ringe, this vol., ii, 370).—The author draws attention to his work on this subject (Abstr., 1906, ii, 324). G. Y.

The Decomposition of Ozone by Heat. Edgar P. Perman and Richard Henry Greaves (*Proc. Roy. Soc.*, 1908, **80**, *A*, 353—369).—The rate of decomposition of ozone in presence of various solid and gaseous substances has been determined at 40°, 60°, 80°, 100°, and 120°. A globe containing about 350 c.c. of dry, ozonised oxygen was heated in a bath of calcium chloride solution at the desired temperature, and the rate of increase of pressure over that in a similar globe containing air was measured by means of a sulphuric acid manometer. The amount of ozone decomposed was calculated from the pressure developed. The ozone was found to be completely decomposed by heating the bottom of the globe to about 300° with a Bunsen burner.

Great difficulty was experienced in obtaining concordant results, especially as a glass globe usually gave a greater velocity when new than after some use. The experimental values cannot be exactly expressed either as a reaction of the first or second order. In the case of glass and platinum surfaces, and also in presence of water vapour, an equation of the second order is to be preferred. In presence of porous pipeclay, copper oxide, magnesium oxide, manganese dioxide, lead peroxide, nickel foil, and nitric oxide, the unimolecular equation gives the better constant.

It was found that the rate of decomposition is largely dependent on the amount of glass surface. When the globe was packed with pieces of glass tubing, increasing the area about six-fold, the velocity at 80°

was increased sixty-fold. Glass wool, loosely packed into the globe, increased the velocity 129 times at 40°.

A few grams of porous pipeclay, granulated CuO, MgO, or MnO_2 in small lumps, produced an enormous acceleration in the rate of decomposition, but purified lead peroxide had comparatively little effect. Consistent results with metallic surfaces were obtained when the metal had been previously heated in ozone. Platinum and nickel foil produce a slight retardation of the change, but platinum black a noticeable acceleration. Silver foil becomes oxidised to silver peroxide.

The small amount of water ordinarily adhering to the glass surfaces was without appreciable effect on the rate of decomposition, but the introduction of larger amounts of water vapour into the globe produced a quickening which was proportional to the mass of water vapour present. In the case of one globe which gave a velocity constant $10^{-6}.122$ with dry ozone at 119·5°, the velocity in presence of m-milligrams of water was $10^{-6}.(122 + 135{\cdot}1\ m)$. A small quantity of nitric oxide (0·2 c.c.) increased the velocity about 1000-fold at 119·1°, but at 10° the oxide appeared to be condensed to liquid nitrogen tetroxide, and induced no decomposition.

The authors argue that if the decomposition takes place instantaneously at the surface of the glass, the velocity of the change is determined by the rate of diffusion of the ozone, and should be proportional to the square root of the absolute temperature. Actually the effect of temperature on the velocity constant is in agreement with the equation $\log k = a + bt$, which takes no account of diffusion towards the surface. The decomposition is much more regular, however, when the surface exposed is large, and it is supposed that this may be due to the increased rapidity and shorter range of the reaction.

Water is said to accelerate the change by favouring the condensation of ozone on the glass, but nitric oxide probably functions chemically by conveying oxygen to the ozone molecules. The metallic peroxides cannot be supposed to act in the same manner, since lead peroxide is almost without effect, whilst copper and magnesium oxides have a great effect. Since a good unimolecular constant is obtained in these cases, it is supposed that the determining factor is the rate of absorption or condensation of ozone on the surface of the oxide.

The velocity of decomposition is increased on reducing the pressure of the oxygen, and to a greater extent on reducing the partial pressure of the oxygen by diluting with nitrogen. This effect cannot be traced to the reversibility of the decomposition, since the authors have shown that the reverse action, although demonstrable at 100°, is so small as to be without influence. The results obtained are not in accord with Jahn's hypothesis (Abstr., 1906, ii, 225) that a second reaction takes place, $O_3 + O = 2O_2$, and the authors prefer to suppose that variation of the oxygen pressure produces a difference in the gas-film at the surface of the glass. The conclusion is drawn that pressure measurements give no indication of the number of molecules interacting.

R. J. C.

The Iron Oxide Contact Process. GUSTAV KEPPELER (with JEAN D'ANS, IVAR SUNDELL, FRANZ KAISER) (*Zeitsch. angew. Chem.*, 1908, **21**, 532—546, 577—589).—A long paper in which the mechanism of the reaction between sulphur dioxide and oxygen in presence of oxides of iron is discussed. In the process in question, the mixture of sulphur dioxide, oxygen, and nitrogen is first passed over burnt pyrites at about 700°, the sulphur trioxide is absorbed, and the residual gases, which contain relatively more oxygen than the original mixture, are then passed over platinum at 450° to 500°. By means of the known equilibrium constants of the reaction $2SO_2 + O_2 = 2SO_3$, it is shown that the yields obtainable in this way are better than those given by one treatment with platinum at the lower temperature.

The equilibrium $Fe_2(SO_4)_3 \rightleftarrows Fe_2O_3 + 3SO_3$ is studied between 638° and 721°, the sulphur trioxide, of course, dissociates partially. The partial pressures of sulphur trioxide are given by the equation $\log p = -44720/2T + 11{\cdot}8626$.

At higher temperatures, iron oxide brings about the combination of sulphur dioxide and oxygen in the same way as platinum; the partial pressure of sulphur trioxide increases as the temperature falls, until a point is reached at which it is equal to the dissociation pressure of ferric sulphate; at lower temperatures it is absorbed by the catalyst, and the yield therefore falls off; there is thus a temperature of maximum yield. For pyrites-burner gases containing 7, 4, and 2% of sulphur dioxide, these temperatures of maximum yields are 665°, 650°, and 628° respectively, and the possible yields are 53·2, 65·0, and 72·5%. A comparison with the results of manufacturing practice shows that the process is carried on slightly above the temperature of maximum yield, and that the loss of sulphur by absorption is very small.

The catalytic action of ferric oxide has been ascribed to an alternate reduction and oxidation: $3Fe_2O_3 + SO_2 = 2Fe_3O_4 + SO_3$ and $4Fe_3O_4 + O_2 = 6Fe_2O_3$. It is found, however, that sulphur dioxide has no action on ferric oxide below 600°, and the reaction is extremely slow at higher temperatures. Copper oxide is rapidly reduced, thus:

$$3CuO + SO_2 = CuSO_4 + Cu_2O.$$

A second possibility is that sulphur dioxide and oxygen combine with ferric oxide, and the ferric sulphate produced then dissociates, yielding sulphur trioxide. It is found that the absorption of sulphur dioxide and oxygen begins about 230°. A number of experiments in which a mixture of sulphur dioxide, oxygen, and nitrogen is passed over ferric oxide at 500° shows that equilibrium in the gaseous phase is reached rapidly, whilst the concentration of the sulphur trioxide is always much higher than that corresponding with equilibrium with ferric sulphate, that is, sulphur trioxide is first formed and then combines with ferric oxide.

Another set of measurements shows that sulphur dioxide is adsorbed by ferric oxide, the adsorption being of the same order of magnitude as that observed with platinum; the author draws the conclusion that the catalysis is due to a condensation of gases on the surface of the catalyst.

The absorption of arsenic by burnt pyrites, which is the most important technical advantage of their use, is shown to be due to the formation of arsenic acid. This is reduced to arsenious acid (which volatilises) by sulphur dioxide alone, but not by a mixture containing oxygen. T. E.

Selenium. WILLIAM OECHSNER DE CONINCK and RAYNAUD (*Bull. Acad. roy. Belg.*, 1908, 57. Compare Abstr., 1907, ii, 613).—The crystalline and amorphous varieties of selenium, obtained by the action of sulphurous acid on selenious acid, when exposed to light during seven months undergo condensation. The first becomes compact, develops a metallic lustre, and shows a crystalline structure on fracture. The second forms slaty, amorphous leaflets devoid of lustre. T. A. H.

Atomic Weight of Tellurium. H. BRERETON BAKER (*Chem. News*, 1908, **97**, 209—210. Compare Trans., 1907, **91**, 1849).—A criticism of the use of crystallised telluric acid as the starting point for the determination of the atomic weight of tellurium. The impractibility of obtaining telluric acid, which contains water in the exact proportion required by the formula $H_2TeO_4,2H_2O$, is shown to be the probable cause of the low value for the atomic weight obtained by Marckwald (this vol., ii, 33). The phenomenon described by Bettel (this vol., ii, 372) cannot be ascribed to the presence of a new element in tellurium. When pure silver tellurate is reduced to telluride by heating in hydrogen, and the telluride is cupelled with lead, spreading of the silver bead takes place. When pure tellurium is added to silver and cupellation carried out in the same way, the spreading is very much smaller, but this is shown to be due to the fact that most of the tellurium volatilises before combination with the silver has set in. The phenomenon of spreading can therefore be observed with the purest tellurium, and the probable explanation is that silver telluride has a lower surface tension than pure silver. H. M. D.

Homogeneity of Tellurium. VICTOR LENHER (*J. Amer. Chem. Soc.*, 1908, **30**, 741—747).—Mendeléeff (Trans., 1889, **55**, 649) and Brauner (Trans., 1889, **55**, 411) have expressed the opinion that tellurium is not a single element, but probably a mixture of "true" tellurium with an element of higher atomic weight. Norris, Fay, and Edgerley (Abstr., 1900, ii, 272) and Baker and Bennett (Trans., 1907, **91**, 1849), however, consider that tellurium is homogeneous.

It has been shown (following abstract) that, by the action of certain liquid anhydrous chlorides on tellurium or its dioxide, tellurium tetrachloride or a double chloride is formed. The mother liquors from these reactions contain the excess of the anhydrous chloride together with some tellurium. When this tellurium is separated from the mother liquors and purified, it always gives the same value for the ratio Te : TeO_2 as does that contained in the crystalline reaction product, corresponding with the atomic weight 127·5. Similarly, the fractions obtained by partial precipitation of solutions of tellurium tetrachloride with ferrous salts all show the same atomic weight.

Experiments have also been made on the action of hydrochloric acid on tellurium in presence of air, and it is found that the dissolved and undissolved portions of the element are identical in characters and atomic weight. These results, therefore, support the view that tellurium is a true element. E. G.

Action of Various Anhydrous Chlorides on Tellurium and on Tellurium Dioxide. VICTOR LENHER (*J. Amer. Chem. Soc.*, 1908, **30**, 737—741).—In an earlier paper (Abstr., 1902, ii, 316), it has been shown that when tellurium is treated with excess of sulphur monochloride, tellurium tetrachloride and sulphur are produced. Krafft and Steiner (Abstr., 1901, ii, 235), however, have found that, when an excess of tellurium is heated with sulphur monochloride, tellurium dichloride is formed.

When tellurium dioxide is treated with excess of sulphur monochloride, tellurium tetrachloride is formed in accordance with the equation: $TeO_2 + 2S_2Cl_2 = TeCl_4 + SO_2 + 3S$. If, however, an excess of tellurium dioxide is heated with the reagent, the dichloride is produced, thus: $TeO_2 + S_2Cl_2 = TeCl_2 + S + SO_2$.

[With C. W. HILL.]—Thionyl chloride reacts with both tellurium and its dioxide, forming the tetrachloride when the reagent is in excess, and the dichloride when the element or oxide is in excess. Sulphuryl chloride reacts with tellurium to form the tetrachloride, but when the element is in excess, the dichloride is produced. Tellurium dioxide is not affected by sulphuryl chloride in the cold, but on heating the mixture in a sealed tube, crystalline *products* are formed which vary in composition, thus: $3TeO_2,4SO_2Cl_2$; $5TeO_2,9SO_2Cl_2$; $TeO_2,2SO_2Cl_2$; $2TeO_2,5SO_2Cl_2$.

Arsenic and antimony trichlorides react with tellurium dioxide with formation of tellurium tetrachloride and arsenic or antimony trioxide. Lead tetrachloride converts both the element and the oxide into tellurium tetrachloride. Phosphorus trichloride is without action on tellurium, but reduces its oxide to the element. Carbon tetrachloride does not react with either the element or the oxide. When tellurium dioxide is treated with antimony pentachloride, the *compound*,

$$TeCl_4,SbCl_5,$$

is produced, which forms white, tabular crystals, and is readily decomposed by water. Similarly, phosphoryl chloride reacts with the oxide to form the *compound*, $TeCl_4,POCl_3$, which crystallises in deliquescent, monoclinic plates, and is decomposed by water. E. G.

Metallic Nitrides and their Magnetic Properties. I. I. I. SHUKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 457—459).—The author has investigated the absorption of nitrogen by finely-divided magnesium, calcium, aluminium, titanium, vanadium, chromium, manganese, iron, copper, molybdenum, and tungsten. The metal was placed in a porcelain tube, which was exhausted, connected with a nitrogen supply, and heated in an electric furnace. The tube was connected with a manometer, and the temperatures at which absorption of nitrogen by the metal commenced were measured by a pyrometer. Vanadium, iron, copper, and tungsten do not absorb nitrogen at temperatures below 1250°, whilst molybdenum absorbs only traces. The rest of the metals named absorb nitrogen rapidly. The temperatures at which this absorption begins are as follows: magnesium, 780—800°; calcium, 780—800°; aluminium, 800—825°; titanium, 900—925°; chromium, 800—820°; manganese, 850—875°. In no case does the metal melt, although in several instances the temperatures at which absorption of the gas apparently begins are considerably above the melting points of the metals; it is probable that a slight amount of absorption proceeds at lower temperatures than those given above.

The products formed consist, in the cases of magnesium, calcium, and aluminium, of the definite compounds Mg_3N_2, Ca_3N_2, and AlN. Manganese absorbs 12%, chromium 8%, and titanium 21% of nitrogen, the products in these instances consisting either of solid solutions of nitrogen in the metals or of solutions of definite nitrogen compounds in excess of the various metals.

The manganese product, containing 12% of nitrogen, exhibits magnetic properties almost as intense as those of iron, and the chromium and titanium products are also distinctly magnetic.

T. H. P.

Behaviour of Metals when Heated in Ammonia. George G. Henderson and J. C. Galletly (*J. Soc. Chem. Ind.*, 1908, **27**, 387—389. Compare Fowler, Trans., 1901, **79**, 285; White and Kirschbaum, Abstr., 1906, ii, 853).—Beilby and Henderson found (Trans., 1901, **79**, 1245) that when heated in a current of dry ammonia, certain metals are more or less completely converted into nitrides, or, if the conditions are such that the nitrides are not stable, undergo marked change in their physical properties, whilst other metals do not in any case yield nitrides, but undergo similar physical changes, which are probably caused by continuous formation and decomposition of an unstable nitride. In all cases, the ammonia undergoes decomposition into its elements to an extent varying with the nature of the metal and the temperature of the experiment. The work has now been extended to a number of other metals, and similar results have been obtained.

At 800°, finely-powdered manganese is almost completely converted into a dull black *nitride*, Mn_3N_2, whilst at 850° chromium yields a similar product, which is probably the *nitride*, Cr_3N_2, containing small amounts of unchanged metal. The resistance of the members of the chromium group to the action of ammonia, or the instability of the nitride, increases with the atomic weight: at 850°, molybdenum yields a product containing only 2·4% to 3·1% of nitrogen, whilst tungsten is only slightly altered in appearance and contains not more than traces of a nitride.

The action of ammonia on titanium at 800° leads to the formation of a dull bronze product containing 5% to 6·8% of nitrogen. Tin does not yield a nitride under any conditions, but at an incipient red-heat decomposes a large proportion of the ammonia passed over it, the rate of decomposition diminishing with the temperature; the metal becomes frosted in appearance, showing under the microscope a number of minute bubbles. Lead behaves in a similar manner.

The behaviour of cadmium is similar to that of zinc. The powdered metal is partly converted into a green nitride; with cadmium foil, little or no nitride could be detected, but the appearance of the metal underwent the usual change.

Palladium does not yield a nitride, but decomposes large amounts of ammonia, and forms a number of rounded particles, which have the appearance of having been partly fused.

The nitrides described are decomposed when heated in air; they differ to a considerable extent in their stabilities towards water, acids, and hydrogen at red-heat. G. Y.

Solution of Metals in Non-metallic Solvents. II. Formation of Compounds between Metals and Ammonia. Charles A. Kraus (*J. Amer. Chem. Soc.*, 1908, **30**, 653—668).—In an earlier paper (Abstr., 1907, ii, 935), an account was given of the general properties of solutions of metals in liquid ammonia and other non-metallic solvents.

Joannis (Abstr., 1890, 209, 560) separated substances formed by potassium and sodium with ammonia, and assigned to them the composition KNH_3 and $NaNH_3$. Similarly, Moissan (Abstr., 1899, i, 410; ii, 152) obtained the products $LiNH_3$, $Ca(NH_3)_4$, and $LiNH_2Me$. Ruff and Geisel (Abstr., 1906, ii, 228) expressed the opinion that these substances are not definite compounds, but mixtures of the metal with its saturated solution in ammonia.

Joannis (*loc. cit.*) has investigated the pressure of the sodium–ammonium and potassium–ammonium systems. An examination of his results by the application of the phase rule has led to the conclusion that the compounds $NaNH_3$ and KNH_3 do not exist. It is also found from the pressure relations that the substance $LiNH_3$ has no existence, and it is shown independently that, in a system containing lithium and a small quantity of ammonia, a saturated solution of the metal in ammonia is produced.

Calcium yields a solid *compound*, $Ca(NH_3)_6$, analogous to the barium and strontium compounds described by Mentrel (Abstr., 1903, ii, 77) and Roederer (Abstr., 1905, ii, 455). This substance has optical and electrical properties identical with those of its saturated solution.

The vapour pressures of saturated solutions of lithium and of the compound $Ca(NH_3)_6$ in ammonia, and the dissociation pressure of the calcium compound, have been determined. The heat of combination of calcium with gaseous ammonia to form the compound $Ca(NH_3)_6$ has been calculated and found to be 10·23 Cal., whilst the heat of solution of the compound by ammonia is 5·46 Cal. per gram-mol. The heat of solution of lithium is 8·70 Cal. per gram-mol. of gaseous ammonia.

The constitution of the compound $Ca(NH_3)_6$ is discussed, and it is considered probable that the ammonia is combined in the same manner as it is in the ammonio-salts. It is therefore proposed to call the compound calcium hexa-ammoniate. E. G.

Solubility of Nitric Oxide in Aqueous Solutions of Ferrous Sulphate, Nickel Sulphate, Cobalt Sulphate, and Manganese Chloride. FRANCIS L. USHER (*Zeitsch. physikal. Chem.*, 1908, 62, 622—625. Compare Manchot and Zechentmayer, Abstr., 1907, ii, 93; Hüfner, Abstr., 1907, ii, 552).—It was hoped that the nature of the compound formed when nitric oxide is dissolved in ferrous sulphate might be elucidated by a study of the freezing point of the solution, but it was found that, owing apparently to chemical interaction, neither the pressure of the nitric oxide nor the freezing point of the solution remained constant. After the removal of the nitric oxide from the solution, a small quantity of ferric hydroxide was actually detected. That nitric oxide is reduced by ferrous sulphate solutions is shown also by the fact that the volume of the gas absorbed gradually increases as time goes on.

The author, in disagreement with Hüfner (*loc. cit.*), finds that nickel sulphate, cobalt sulphate, and manganese chloride behave like other salts, and diminish the solubility of nitric oxide in water. Comparable results for the absorption-coefficient in the various salt solutions are obtained only by redetermining the solubility in water for each sample of the gas prepared. Attention is drawn to the fact (see Emich, Abstr., 1892, 940) that nitric oxide is decomposed by potash, and that for nitric oxide, washed by passing through concentrated sulphuric acid, a smaller absorption-coefficient is obtained than for nitric oxide washed by passing through potash. J. C. P.

Preparation of Nitrogen Peroxide. PAUL WINANS (D.R.-P. 193696).—When the mixture of nitric oxide and nitrogen peroxide, evolved by acid from a nitrite, reacts with nitrogen pentoxide, the following change occurs: $NO + NO_2 + N_2O_5 = 4NO_2$, and pure nitrogen peroxide is produced.

An intimate mixture of alkali nitrite and nitrate is treated with fuming sulphuric acid, and the production of the pure peroxide occurs in accordance with the equation: $NaNO_3 + NaNO_2 + H_2S_2O_7 = 2NaHSO_4 + 2NO_2$. Sufficient of the hydrogen sulphate from an earlier operation is added to fix any excess of sulphur trioxide: $2NaHSO_4 + SO_3 = Na_2S_2O_7 + H_2SO_4$. The homogeneous mixture of the two salts is ensured either by using the salts in the molten condition or by pouring the fused mixture into carbon tetrachloride or into a saturated aqueous solution of the salts themselves. G. T. M.

Production of Nitric Acid during Electric Discharge in Air. GUSTAV MEYER (*Chem. Zentr.*, 1908, i, 794; from *Zeitsch. phys.-chem. Unter.*, 1908, 21, 40).—Filter paper coloured with an alcoholic solution of diphenylamine, placed in the path of the spark, shows a yellow colour, which, after long action, develops a blue margin analogous to the reaction given by dilute nitric acid. J. V. E.

Red Phosphorus. GOTTLOB E. LINCK and P. MÖLLER (*Ber.*, 1908, 41, 1404—1410).—Rydberg failed in an attempt to find a relation between the hardness and the m. p. of phosphorus, arsenic, antimony, and bismuth (Abstr., 1900, ii, 322) because he compared modifications of the elements which are not strictly comparable. Before commencing similar experiments, the authors have endeavoured in the present communication to ascertain whether red phosphorus is comparable with "mirror" or with metallic arsenic, and whether together with the crystalline modification an amorphous variety of red phosphorus exists, as several investigators claim.

Red phosphorus was prepared by Hittorf's method, and, after removal of the excess of lead by dilute nitric acid, the residue consisted of small, black, metallic, monoclinic crystals

$$[a : b : c = 1·651 : 1 : 1·46 ;\ \beta = 72°40']$$

containing about 62% of lead. The substance therefore is not crystalline phosphorus as was supposed, but a compound of lead and phosphorus.

Washed and dried red phosphorus was heated in a vacuous tube at the temperature of melting lead; the sublimate was a dense, black, brittle mass, devoid of crystalline structure, containing 99·4% of phosphorus, and having D^{18-20} 2·145—2·192. The identity of this modification with commercial red phosphorus was indicated by prolonged heating at 450°, whereby both varieties are changed into a denser crystalline form, D 2·280—2·304.

The second object of the investigation was attacked by heating mixtures of red phosphorus and metallic arsenic; the density of the sublimate was determined by the floating method, and also calculated from the composition and the densities of red phosphorus, and of the several modifications of arsenic. The best agreement was obtained when the density of "mirror" arsenic was used. C. S.

Constitution of Phosphorous Acid. F. Carlo Palazzo and F. Maggiacomo (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 432—438).—The authors discuss the bearing of the work of previous investigators on the validity of the symmetrical, $P(OH)_3$, and unsymmetrical formulæ, $O:PH(OH)_2$, which have been proposed for phosphorous acid. Their own results indicate that the unsymmetrical formula is the correct one.

When phosphorous acid is treated in an atmosphere of dry carbon dioxide with diazoethane, it is converted completely into the diethyl salt, which, like the free acid, must hence have an unsymmetrical structure.

Under the same conditions, selenious acid gives an almost theoretical yield of *s*-diethyl selenite. This acid has therefore a symmetrical structure (compare Werner, Abstr., 1895, ii, 225; *Zeitsch. anorg. Chem.*, 1895, 8, 194). T. H. P.

Decomposition of Arsenic Hydride. Alfred Stock, Eusebio Echeandia, and Paul R. Voigt (*Ber.*, 1908, 41, 1319—1323).—The similarity between arsenic and antimony hydrides suggested the study of the decomposition of the arsenic compound from the same point of view as that already carried out for antimony hydride (compare this vol., ii, 503). The experiments were carried out, not in a flask, but in a Jena glass cylinder 10 cm. in length and 3·5 cm. in diameter, and heated by diphenylamine vapour (304°), a temperature which has the disadvantage that the decomposition is somewhat slow, but a higher temperature is inadvisable, as otherwise arsenic sublimes into the capillary tube leading to the manometer. The velocity of decomposition of the arsenic hydride is greater at the beginning in a vessel free from an arsenic mirror, but as soon as the vessel is covered with arsenic the velocity decreases and then increases again. When a series of experiments is carried out in the same vessel, the velocity of the reaction diminishes from experiment to experiment. In a third experiment, the decomposition was complete after seven days, although 95% was decomposed during three days.

The mirror so formed is irregular in thickness, some portions of the vessel being free from arsenic, and others being covered with a non-transparent layer. A microphotograph is given, showing the ring formation round a large arsenic crystal.

Experiments carried out at 444° (b. p. of sulphur) show that the decomposition velocity is great, but no mirror is obtainable in the apparatus, as sublimation is immediate.

Air and hydrogen sulphide have no influence on the reaction.

The decomposition velocity increases with decreasing arsenic hydride concentration, and this agrees with the explanation that decomposition occurs in the adsorbed gas layer. W. R.

The Hydrates of Arsenic Acid. VICTOR AUGER (*Compt. rend.*, 1908, **146**, 585—588).—The hydrate of arsenic acid described by Joly and Auger (Abstr., 1902, ii, 393), as $As_2O_5,1\frac{1}{2}H_2O$, and subsequently prepared by Baud (Abstr., 1907, ii, 761), is now shown to be $As_2O_5,1\frac{2}{3}H_2O$.

The hydrate, $As_2O_5,4H_2O$, can give up water vapour even at −10°, and the dehydration of this substance, whether over phosphoric oxide, sulphuric acid, or potassium hydroxide, proceeds regularly at the ordinary temperature until the composition $As_2O_5,1\frac{2}{3}H_2O$ is attained. There is no indication that pyroarsenic acid, $As_2O_5,2H_2O$, is produced under these conditions as an intermediate product, as claimed by Baud. R. J. C.

Austenite. ED. MAURER (*Compt. rend.*, 1908, **146**, 822—824).—Austenite, the solid solution of carbon in γ-iron discovered by Osmond, has hitherto only been obtained as an alloy with manganese steel containing 13% of manganese, and nickel steel containing 25% of nickel. The best specimen obtained by Osmond (from a cementation steel containing 1·6% of carbon) was two-thirds composed of austenite and one-third martensite. The author has heated specimens of three steels containing: (1) 3·73% of nickel, 1·21% of carbon, and 0·28 of silicon; (2) 1·83% of manganese, 1·18% of carbon, and 0·88% of silicon, and (3) 2·20% of manganese, 1·94% of carbon, and 0·94% of silicon, at 1050° for fifteen minutes and tempered them in ice-water. He finds that the two first specimens give martensite, but the third gives pure austenite. The austenite on metallographic examination is found to be constituted of cells exhibiting well-defined macles; it is not magnetic, and its hardness is relatively low. It can be transformed into martensite, and thus considerably hardened by mechanical deformation at the ordinary temperature, by annealing at about 400°, or by immersion in liquid air. Photomicrographs are given: (1) of homogeneous austenite, (2) of austenite transformed by mechanical deformation, and (3) austenite transformed by annealing.

Similar treatment of a steel containing less manganese gives a metal consisting of both austenite and martensite. E. H.

Austenite. Henri le Chatelier (*Compt. rend.*, 1908, **146**, 824—826. Compare preceding abstract).—The author obtained homogeneous austenite on one occasion by heating a steel containing 1·5% of carbon and about 1% of manganese at 1200° for two hours and tempering in a reducing medium, but, failing to determine the essential conditions, has never succeeded in repeating the experiment. Maurer's discovery is important from a scientific point of view in that it facilitates the study of the properties of austenite normally stable only above 800°, and from a practical standpoint by furnishing a steel which is both cheaper and more readily worked than the manganese steel, used where great resistance to wear by friction is required, and the nickel steel employed on account of its extraordinary toughness. E. H.

Currents in Water due to the Dissolution of Carbon Dioxide. H. Rebenstorff (*Chem. Zentr.*, 1908, i, 704; from *Zeitsch. phys.-chem. Unter.*, 1908, **21**, 39).—Water, faintly-coloured by a trace of phenolphthalein and sodium hydroxide, in contact with carbon dioxide shows a colourless surface, and on standing, owing to convection currents, due to the density of the solution of carbon dioxide in water, and diffusion, the entire liquid becomes colourless. A similarly-coloured salt solution requires a much longer time for this to take place. J. V. E.

Preparation of Silicic Acids. Gustav Tschermak (*Centr. Min.*, 1908, 225—230).—A reply to Mügge (this vol., ii, 277). L. J. S.

Experiments on the Condensation of Helium by Expansion. H. Kamerlingh Onnes (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **10**, 744—747).—The author describes the experiments which at first led him to announce the liquefaction of helium. He now considers that the phenomena observed were due to the presence of hydrogen as impurity in the sample of helium employed.

Nearly 7 litres of helium, purified by passing over heated copper oxide and over charcoal immersed in liquid hydrogen, were compressed at 100 atmospheres in a thick-walled tube immersed in liquid hydrogen, evaporating under such a pressure that solid hydrogen just appeared on the surface. When the compressed gas was allowed to expand, a dense, grey cloud appeared, from which solid masses separated, floating in the gaseous helium, and denser masses which passed slowly down the tube, but soon disappeared. There was no appearance of melting.

Subsequent investigation showed that this sample of helium contained about 0·4% by volume of hydrogen, and, when the latter was removed as far as possible, no cloud was noticed on repeating the above experiment, but on a subsequent occasion, with more rapid expansion, a thin cloud was observed. This effect might, however, be due to the small traces of hydrogen still remaining.

The results first obtained are due in all probability to the solution phenomena of solid hydrogen in gaseous helium. It remains somewhat surprising, when the small amount of hydrogen (not much more than 1 mg.) is taken into account, that the tube, which held 7 c.c., was over its whole length about one-quarter full of a flaky substance.

G. S.

Electrolysis of Chlorides. André Brochet (*Bull. Soc. chim.*, 1908, [iv], 3, 532—543).—In a previous paper, it was shown that the presence of cobaltous oxide in a solution of potassium chloride undergoing electrolysis for the production of chlorate, inhibited the formation of chlorate, and this was regarded as evidence in favour of the view that hypochlorite is initially formed in this reaction, and is decomposed by the cobaltous oxide (Abstr., 1900, ii, 541; compare Foerster and Jorre, *ibid.*, 343; Guye, Abstr., 1903, ii, 586; Briner, Abstr., 1907, ii, 68, 734). The results recorded in the present paper support the view stated previously.

When alkali chlorides are electrolysed in a diaphragm apparatus, the percentages of the theoretical yields of the corresponding hydroxides actually obtained diminish as the experiment proceeds. The yields, expressed in percentages of the theoretical, obtained in the cases of the following chlorides, initially and after ten hours, are as follows: sodium chloride, 96 and 70·4; potassium chloride, 96 and 71·7, and barium chloride, 92 and 56.

The experiments on the influence of metallic hydroxides on the electrolytic formation of potassium chlorate have been extended and repeated in an apparatus permitting of agitation of the electrolyte, and it was found that hydroxides of cobalt or nickel strikingly reduce the yield of chlorate. Mercuric hydroxide also exerts this action, but to a less extent, and copper hydroxide to a still less extent, whilst hydroxides of lead, iron, zinc, aluminium, or chromium have little or no effect.

It was found that films of cobalt or nickel decompose solutions of hypochlorite rapidly, whilst metallic copper effects a slow decomposition of the salt. Iron and lead exert a considerable decomposing effect, whilst zinc has no action. In all these cases, oxygen is the chief gas evolved. When magnesium or aluminium is placed in a solution of sodium hypochlorite, energetic action ensues, but in these cases hydrogen is the chief gas evolved, so that these metals are probably attacked by the excess of alkali in the solution. It will be seen that it is precisely those metals the hydroxides of which inhibit the formation of potassium chlorate which decompose sodium hypochlorite.

Experiments show that cathodes of platinum, cobalt, copper, or tin, used in conjunction with platinum anodes, are all equally efficient in the electrolysis of potassium chloride to chlorate, but in using cobalt (or nickel) there is always a risk of the formation of the oxide of the metal, owing to stoppage of the current, and the same risk attends the use of cupric oxide cathodes. Carbon anodes behave rather differently from platinum anodes, and the amount of oxygen evolved in this case is not a safe guide to the diminution in yield of chlorate, as part of the oxygen is used up in oxidising the carbon of the anode. Zinc electrodes would appear to answer the purpose best. T. A. H.

Study of the Solubility of Potassium Platinichloride. Ebenezer H. Archibald, W. G. Wilcox, and B. G. Buckley (*J. Amer. Chem. Soc.*, 1908, **30**, 747—760).—Since a knowledge of the solubility of potassium platinichloride is of considerable importance in analytical work, a study has been made of the solubility of the salt in water, methyl and ethyl alcohols, mixtures of these alcohols and *iso*butyl alcohol with water, and in solutions of potassium and sodium chlorides.

The weights of potassium platinichloride which dissolve in 100 grams of water are: at 2°, 0·4812; at 16°, 0·6718; at 25°, 0·8641; at 35°, 1·132; at 48°, 1·745; at 59°, 2·396; at 68°, 2·913; at 78°, 3·589; and at 92°, 4·484 grams. These results are compared with those of previous investigators. Potassium platinichloride is soluble at 20° to the extent of 0·0027 gram in 100 grams of methyl alcohol, and 0·0009 in 100 grams of ethyl alcohol. The platinichloride is less soluble in mixtures of ethyl alcohol and water than in aqueous solutions of either methyl or *iso*butyl alcohol. The solubility in potassium chloride solutions decreases as the concentration of the potassium chloride increases, until a concentration of 1 gram-mol. per litre is reached. Beyond this point, the concentration of the potassium chloride has no effect. The solubility in sodium chloride solutions increases rapidly up to a concentration of 0·05 gram-mol. per litre. In more concentrated solutions, the solubility increases very slightly, and almost proportionally to the increase in the concentration of the sodium chloride.

In the determinations of the solubility in alcohols, it was found that, on evaporating the solutions, reduction of the platinichloride took place. A colorimetric method of estimation was therefore adopted, involving the use of Nessler tubes, and was found to give accurate results. E. G.

Silicates. VIII. Alkali Silicates. Eduard Jordis (*Zeitsch. anorg. Chem.*, 1908, **58**, 98—101. Compare Abstr., 1905, ii, 161, 248, 317; this vol., ii, 103, 291).—From a strong solution of potassium silicate, after remaining for some months over sulphuric acid, thin plates separated which, after freeing as far as possible from the mother liquor, had the approximate composition

$$K_4SiO_4,2KOH,8H_2O.$$

No crystalline silicate of potassium had been prepared previously.

When to fused sodium hydroxide, silica is added in the ratio $8NaOH:SiO_2$, large, colourless leaflets are formed, which probably represent an orthosilicate of sodium, but the compound has not been obtained pure. G. S.

Sodium Hypochlorite: Properties of the Electrolytic Bleaching Solution. H. Pusch (*Centr. Bakt. Par.*, 1908, i, **46**, 520—538).—A description is given in detail of the estimation and technical preparation of a bleaching solution by the electrolysis of sodium chloride solution. The stability of the sodium hypochlorite solution when exposed to light, and its action on dyes and colouring matters of various types, including those of urine and blood, has been examined and the results, using bleaching solution of various strengths, tabulated. Its value as a disinfectant is strikingly shown by the results of a series of experiments with dilute solutions on town sewage effluent and certain pathogenic micro-organisms. J. V. E.

Action of Heat on the Lithium Hydroxides. ROBERT DE FORCRAND (*Compt. rend.*, 1908, **146**, 802—806).—The hydroxide, $LiOH,H_2O$, prepared by Dittmar (*J. Soc. Chem. Ind.*, 1888, 7, 731) in a not quite anhydrous condition, is obtained free from water by heating Dittmar's product in a current of hydrogen at 33° for one hour. Its heat of dissolution at +15° and *M*/2 dilution is +0·51 Cal. When this hydroxide is kept in a vacuum desiccator for several weeks, or, better, heated for an hour in a current of hydrogen not above 140°, it is transformed into pure lithia, LiOH, a white, efflorescent substance, which is polymerised to the same extent as the hydrated compound. This is the only way that lithia can be prepared, and it cannot be obtained fused. Its heat of dissolution is +4·465 Cal., from which the values +3·955 Cal. and +13·615 Cal. respectively for its heat of combination with liquid and gaseous water are deduced. From the latter figure, 181° is calculated as the dissociation temperature of the hydroxide, $LiOH,H_2O$, and this is in accordance with the fact that it evolves water at 140° in a current of hydrogen.

Commercial pure lithia has a composition varying between

$$LiOH,0{\cdot}15H_2O$$

and $LiOH,0{\cdot}19H_2O$, after allowing for impurities. This does not evolve water when heated at 140° in a current of hydrogen, but at 445° it melts, loses a small quantity of water, and the product has the composition $LiOH,0{\cdot}125H_2O$, which is not altered by heating at 480° for several hours. The product, which forms a white, translucent, nacreous, fissured mass with a crystalline fracture, seems to be a condensed hydroxide at least as complex as would correspond with the formula $4Li_2O,5H_2O$. The heat of dissolution of $LiOH,0{\cdot}125H_2O$ is +4·091 Cal. By heating this hydroxide in a current of hydrogen at 570° until water ceases to be evolved, it is transformed into an opaque, white, non-crystalline, enamel-like substance of the composition $Li_2O,0{\cdot}75H_2O$, probably a second condensed hydroxide polymerised to the same degree, $4Li_2O,3H_2O$, as the first. The heat of dissolution of $Li_2O,0{\cdot}75H_2O$ at 15° and *M*/4 dilution is +16·026 Cal. During the transformation of the first condensed hydroxide into the second, no slackening in the evolution of water, which would indicate the formation of the compound $4Li_2O,4H_2O$, is observed. When heated in a current of hydrogen at 570°, the second condensed hydroxide very slowly loses water, but no other definite compound is formed. After heating in a current of hydrogen at 780° for two hours, it is transformed into anhydrous lithium oxide, Li_2O (or nLi_2O).

From the difference of the heats of dissolution of the two condensed hydroxides, +31·376 Cal. and +25·348 Cal. are deduced for the heats of combination of ($4Li_2O,3H_2O,2H_2O$ liq.) and ($4Li_2O,3H_2O,2H_2O$ gas) respectively. The dissociation temperature, 572°, is calculated from the heat of combination with steam, and agrees with the observed value. This agreement supports the view that the two condensed hydroxides are equally polymerised. If it is assumed that lithium oxide also is equally polymerised, the value +60·696 Cal. is obtained for the heat of combination of ($4Li_2O,3H_2O$ liq.) and +29·892 Cal. for ($4Li_2O,3H_2O$ gas). The latter result gives 723·4° as the dissociation temperature of the trihydrate, also agreeing with experiment.

By melting together equal molecular quantities of the penta- and tri-hydrates, a product of the composition $4Li_2O,4H_2O$, and having a heat of dissolution, +12 Cal., equal to the mean of those of its components, is obtained. E. H.

Rubidium Dichromate. WILLEM STORTENBEKER (*Bull. Soc. chim.*, 1908, [iv], **3**, 481—483. Compare Abstr., 1907, ii, 764).—A reply to Wyrouboff (this vol., ii, 181), in which the author maintains that (1) the two forms of this salt have different solubilities, and (2) that the monoclinic form in his experience is unstable, and suggests that the difficulty Wyrouboff finds in applying the phase rule to systems in which there is transformation of crystalline phases does not invalidate the rule, but merely requires its extension.

T. A. H.

Preparation of Pure Ammonium Chloride. F. WILLY HINRICHSEN (*Zeitsch. anorg. Chem.*, 1908, **58**, 59—64).—The preparation of pure ammonium chloride by electrolytic reduction of nitric acid is described. To avoid the formation of hydroxylamine, a mixture of nitric acid and copper sulphate was electrolysed at 10 volts and 4·5 amperes, a platinum dish being used as cathode and a rotating perforated platinum plate as anode. When reduction was nearly complete, more nitric acid was added, and the process continued. The reduction product was then placed in a desiccator, which also contained a platinum dish filled with hydrochloric acid. Excess of calcium oxide was added to the solution, and, on exhausting, the ammonia given off was absorbed by the acid. Finally, the ammonium chloride was purified by sublimation in quartz vessels. The results of atomic weight determinations with this salt will be communicated later. G. S.

Existence of Different Modifications of Ordinary Grey Silver. LEO PISSARJEWSKY (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 367—376).—The heat effect observed on mixing solutions of silver and ferrous sulphates, dissolved in water, *N*-sulphuric acid, 10·5% mannitol solution, or 23·7% glycerol solution is found to vary with the conditions under which the reaction takes place. Similar variations are found to occur in the constant of the reaction: $Ag^{\cdot} + Fe^{\cdot\cdot} \rightleftarrows (Ag) + Fe^{\cdot\cdot\cdot}$. Hence the conclusion is drawn that in these reactions a mixture of different modifications, probably two in number, of ordinary grey silver is precipitated. T. H. P.

Certain Alloys of Silver. ERNESTO PANNAIN (*Gazzetta*, 1908, 38, i, 349—351. Compare Petrenko, Abstr., 1907, ii, 346).—The author has examined various alloys of silver to ascertain whether they are suitable for coinage.

The binary alloys of silver with cobalt, nickel, iron, or manganese are not readily prepared, and are unsuitable for the purpose named; in presence of a third metal, the alloys are more readily formed. Silver, nickel and copper, or silver, cobalt and copper, or silver, manganese and copper, when fused together, give alloys containing the three metals in various proportions, and those which are rich in silver are white, compact, malleable, harder than alloys of silver and copper, and capable of being polished. Further, although an alloy consisting of equal parts of nickel and copper is not attracted by a magnet, alloys rich in silver and containing small proportions of copper and nickel are distinctly magnetic. This magnetic property persists if the nickel in these alloys is replaced wholly or partly by cobalt, or if the copper is replaced by another non-noble metal. A high temperature is necessary in the preparation of these alloys; otherwise, two alloys are formed, one rich in silver, and the other containing about 30% of this metal. T. H. P.

The Colloidal and Gelatinous Salts of the Alkaline Earths. II. CARL NEUBERG and B. REWALD (*Biochem. Zeitsch.*, 1908, 9, 537—550. Compare Abstr., 1906, ii, 753).—When carbon dioxide is passed through a methyl-alcoholic solution of barium oxide, the liquid remains clear; after a time it suddenly gets warm, and barium carbonate separates in a gelatinous form. On passing more carbon dioxide through the mass, a clear solution is formed of typical colloidal character of the consistency of thick collodium. The addition of sulphuric acid to this produces a thick clot of gelatinous barium sulphate. The barium carbonate colloid, as long as it contains methyl alcohol, is a reversible one, and readily redissolves on adding excess of solvent; if, however, completely freed from solvent, it only partly redissolves. It does not diffuse through the ordinary membranes when dialysed against water or methyl alcohol. Its electrical conductivity is $k = 31{\cdot}5 \times 10^{-6}$, that is, it is practically a non-conductor. It is possible that this slight conductivity is due to incomplete removal of impurities. Various strontium compounds were also prepared by the action of acids on a solution of strontia in methyl alcohol (namely, a gelatinous sulphate, phosphate, and oxalate). The carbonate is formed in the same way as the corresponding barium compound; no separation of a gel, however, takes place.

By passing carbon dioxide into methyl alcohol containing calcium oxide in suspension, a colloidal solution of the carbonate can be obtained which, after some time, becomes converted into a gel. The solution is miscible with toluene, chloroform, benzene, and ether; the addition of acetone or carbon disulphide causes precipitation.

Similar colloidal compounds can be produced with magnesium. The biological importance of these facts, especially in reference to the formation of lipoid soluble compounds of the alkaline earths, is discussed. S. B. S.

Action of Ammonium Citrate on Calcium Phosphate. Diverse Reactions. A. BARILLÉ (*J. Pharm. Chim.*, 1908, [vi], **27**, 437—441. Compare Grupe and Tollens, Abstr., 1880, 825; 1881, 759, 845; Landrin, Abstr., 1882, 604).—After twelve hours' digestion, 100 c.c. of the ammonium citrate solution, obtained by exactly neutralising 400 grams of citric acid with ammonia and diluting the solution to 1 litre, dissolves the mean quantity of 4·10 grams of dicalcium hydrogen phosphate, $Ca_2H_2(PO_4)_2,4H_2O$, and 1·40 grams of dry tricalcium phosphate. The solubility of both salts varies with their physical condition. Recently-prepared, gelatinous tricalcium phosphate is more soluble than the dry salt, and the latter becomes insoluble on calcination. Similarly, the dicalcium salt is less soluble when anhydrous, and becomes insoluble on calcination, being transformed into the pyrophosphate. Thus, contrary to the statements of several authors, precipitated tricalcium phosphate is appreciably soluble in ammonium citrate solution.

When a saturated solution of dicalcium hydrogen phosphate in neutral ammonium citrate solution is allowed to evaporate spontaneously, crystals are obtained containing ammonia, calcium, and citric and phosphoric acids. If the evaporation is accelerated, some ammonia is evolved, and a porcelain-like magma of crystalline needles produced. Both substances are probably true double salts. The first can also be obtained by precipitation with alcohol. The same results are obtained with tricalcium phosphate. The conclusion is drawn that ammonium citrate solution has not merely a solvent action on calcium phosphate, but forms true double salts with it.

E. H.

Preparation of Strontium Salts Free from Barium. H. CARON and D. RAQUET (*Bull. Soc. chim.*, 1908, [iv], **3**, 493—495).—The method of preparation described is based on the data recorded in a preceding paper (this vol., ii, 535), which indicate that alkali chromates are the most satisfactory reagents for the elimination of barium from strontium. Where the product under examination contains more than 1% of barium, it is dissolved in ten times its weight of water, and the solution shaken continuously with strontium sulphate during about forty-eight hours. This treatment will reduce the amount of barium in solution to about 1%. To this, excess of a solution containing 3% of potassium chromate and 0·1% of potassium dichromate is added, and the mixture set aside for twenty-four hours, after which the precipitated barium chromate is filtered off and the strontium in solution is converted into carbonate (1) by adding a large excess of sodium carbonate, or (2) by pouring the strontium solution, little by little with continuous agitation, into excess of sodium carbonate. These precautions are necessary to prevent the formation of a slightly soluble double chromate, which would remain in the carbonate and stain it yellow. T. A. H.

Copper-Tin Alloys. OTTO SACKUR and H. PICK (*Zeitsch. anorg. Chem.*, 1908, **58**, 46—58. Compare Abstr., 1904, ii, 336, 818; 1905, ii, 524).—The potential of copper-tin alloys has been determined indirectly from the effect of shaking the finely-divided alloy with solutions of salts of certain other metals. Observations are made whether, and to what extent, the metals are liberated, and, when the potential between the metal and its solution is known, the potential of the tin in the alloy and hence the nature of the alloy can be determined.

Copper-tin alloys containing 0—56% of copper precipitate lead from a solution of lead chloride up to the same equilibrium point as does tin itself, so that they contain free tin. Alloys containing 57—60% of copper do not precipitate lead from lead chloride solution, or copper from cuprous iodide solution, but cause the separation of copper from solutions of cuprous chloride and bromide. Alloys containing more than 60% of copper do not precipitate copper from the two solutions last mentioned, but do from solutions of the chloride and sulphate.

From the results, the conclusion is drawn that copper and tin form two compounds: one, containing 57% of copper, is probably Cu_3Sn, and has a potential about 0·2 volt higher than tin, and the other, containing 60% of copper, has a potential about 0·45 volt higher than tin, and is probably Cu_5Sn_2 or Cu_2Sn. The results are in fair agreement with the recent direct potential measurements of Pushin (Abstr., 1907, ii, 774, 837). G. S.

Reactions of Copper, Bismuth, and Silver with Nitric Acid. JOHN H. STANSBIE (*J. Soc. Chem. Ind.*, 1908, **27**, 365—367. Compare Abstr., 1907, ii, 25).—In continuation of his experiments on the action of nitric acids on metals, the author has studied the changes taking place when electrolytic copper, bismuth, and silver are dissolved in nitric acid, D 1·2, in an atmosphere of hydrogen at 65°. The apparatus employed is described and figured. The gases evolved are passed through sodium hydroxide solution and then into a measuring tube; when the metal is dissolved completely, the solution in the reaction vessel is run into a measured amount of a known sodium carbonate solution. The alkaline solutions are titrated with permanganate for nitrous acid, and with standard acid for excess of alkali. With copper and bismuth, the evolution of nitrogen peroxide is observed immediately the nitric acid comes in contact with the metal, and goes on steadily throughout the reaction; the red gas is absorbed completely by the sodium hydroxide solution. With bismuth, the evolution of the red gas is slightly less marked than with copper; both metals liberate considerable amounts of nitrogen. With silver, nitrogen peroxide is observed only towards the end of the reaction; the volume of gas liberated is smaller than with the other two metals, and nitrogen is not found in the measuring tube. On the other hand, the amount of nitrous acid found in the sodium carbonate is greatest with silver, which is considered to result from the greater stability of silver nitrite. The amount of nitrous acid found in the sodium hydroxide is almost equivalent to the alkali neutralised by the gases absorbed. If the absorption tube is filled with water instead of sodium hydroxide solution, less nitrous acid is found on titration, which is ascribed to its partial decomposition according to the equation: $3HNO_2 = HNO_3 + 2NO + H_2O$. The nitric acid employed is almost completely accounted for. These results are considered to be in agreement with Divers' views on the action of nitric acid on metals (Trans., 1883, **43**, 443; 1899, **75**, 86). G. Y.

Oxides of Thallium. IV. Otto Rabe (*Zeitsch. anorg. Chem.*, 1908, **58**, 23—38. Compare Abstr., 1906, ii, 285, 672; 1907, ii, 769).—The preparation and properties of a new oxide of thallium, $(TlO)_x$ (probably Tl_2O_3,Tl_2O), are described.

To 15 grams of a 10% aqueous solution of thallous sulphate, 175—200 grams of 20% potassium hydroxide are added, the clear, filtered solution is cooled to $-15°$, and 3·5 grams of a 3% solution of hydrogen peroxide added with constant shaking. A red precipitate is momentarily formed, which rapidly gives place to the new bluish-black, lustrous oxide; the latter is separated by filtration, and washed with cooled anhydrous alcohol and ether.

Even cold water decomposes the oxide into a mixture of thallic oxide and thallous hydroxide, and dilute sulphuric and nitric acids act in an analogous way; neither free oxygen nor hydrogen peroxide is produced. On being kept in the air, the oxide absorbs carbon dioxide according to the equation: $Tl_2O_3,Tl_2O + CO_2 = Tl_2O_3 + Tl_2CO_3$; it becomes slowly oxidised at the ordinary temperature in air free from carbon dioxide. When a current of oxygen is passed over it at the ordinary temperature, it is oxidised completely to thallic oxide, which is remarkable, inasmuch as thallous salts are acted on only by powerful oxidising agents. G. S.

Scheme for the Separation of the Rare Earths. Charles James (*Chem. News*, 1908, **97**, 205—209. Compare Abstr., 1907, ii, 467; this vol., ii, 190).—A scheme for the qualitative separation of the rare earths is described in detail. Having obtained the earths in the form of oxalates, zirconium and thorium may be separated by boiling with a solution of ammonium oxalate, when the whole of the zirconium and nearly all the thorium pass into solution. On the addition of hydrochloric acid to the filtered solution, thorium oxalate alone is precipitated. Small quantities of the metals of the yttrium and cerium groups pass into the concentrated ammonium oxalate solution. From the former, thorium can be separated by means of the insolubility of potassium thorium sulphate in a solution of potassium sulphate, and from the latter by the solubility of thorium oxalate in ammonium oxalate or acetate solution, or by the addition of hydrogen peroxide to a solution containing thorium and the cerium earth metals.

The next step in the treatment of the mixed rare earth oxalates depends on the proportion of yttrium earths in the mixture, and on the presence or absence of thorium. When the material consists of more than 20% of the yttrium earths and practically no thorium, the oxalates are converted into sulphates, which are dissolved in ice-cold water and the solution stirred with solid sodium sulphate, which throws down the double sulphates of sodium and the cerium earths. If thorium is present, the mother liquor is then saturated with potassium sulphate, and the separation of the thorium is thus completed by reason of the insolubility of the double potassium sulphate.

Cerium may be separated by treating a neutral nitrate solution with excess of zinc oxide and addition of potassium permanganate; the precipitate obtained consists of cerium and manganese peroxides, together with thorium (if present) and a small amount of lanthanum, praseodymium, and neodymium. The thorium can be removed by the peroxide method, and the cerium can then be separated from the other three rare earths by renewed treatment of the nitrate solution with zinc oxide and a quantity of potassium permanganate insufficient for complete precipitation.

Lanthanum, praseodymium, neodymium, samarium, europium, and gadolinium are best separated by fractional crystallisation of the double magnesium nitrates. The separation of lanthanum from praseodymium is completed by fractional crystallisation of the double ammonium nitrates, and that of praseodymium from neodymium by fractional crystallisation of the double manganese nitrates.

For the separation of terbium, dysprosium, holmium, yttrium, erbium, thulium, ytterbium, and scandium, the bromate method previously described (*loc. cit.*) is recommended. In the previous communication, the position of yttrium in the bromate fractionation was given as between terbium and dysprosium. It is now found that yttrium is obtained from the bromate fractions between holmium and erbium. H. M. D.

Preparation of Aluminium Bromide and its Latent Heat of Fusion. IWAN A. KABLUKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 485—488).—For preparing aluminium bromide in large quantities, the author uses a glass retort, the tube of which connects with a sloping, hard glass tube heated in a combustion furnace and bent at the lower end so as to fit into a glass receiver. After the retort is charged with aluminium chips and the hard glass tube is heated sufficiently to prevent bromine or aluminium bromide from condensing in it, bromine is allowed to fall gradually on to the aluminium from a tap-funnel, bromine vapour from the receiver being conducted to a draught by means of a tube. After redistillation, the aluminium bromide is obtained as a colourless liquid solidifying to a white mass. Any iron in the aluminium is precipitated according to the reaction: $Fe_2Br_6 + 2Al = Al_2Br_6 + 2Fe$.

The mean specific heat of aluminium bromide between 22° and 76° is 0·08912. Determinations of the latent heat of fusion of the bromide gave the values: 10·35, 10·58, and 9·98 Cals. per 1 gram. Taking the value 10·47 for the latent heat, van't Hoff's formula gives the molecular depression of the freezing point of aluminium bromide as 262; experiments with solutions of stannic bromide in aluminium bromide give the mean value 279 for molecular concentrations of stannic bromide not exceeding 12%. T. H. P.

Ferronitrosulphides. VI. ITALO BELLUCCI and PIETRO DE CESARIS (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 424—431. Compare this vol., ii, 111).—When the salt $KFe_4S_3(NO)_7,H_2O$ is heated with dilute sulphuric acid and silver sulphate solution, four of the nitrogen atoms are evolved as nitric oxide and the other three as nitrous oxide. Under similar conditions, the salt $K_2Fe_2S_2(NO)_4$ yields $2NO + 2N_2O$. Pavel (Abstr., 1883, 297) has shown that, when heated with alkali hydroxide solution, the hepta-salt is decomposed according to the equation: $2KFe_4S_3(NO)_7 + 4KHO = 3K_2Fe_2S_2(NO)_4 +$

$Fe_2O_3 + N_2O + 2H_2O$. When, however, cadmium hydroxide is present in addition to potassium hydroxide, both the hepta- and tetra-salts yield all their nitrogen in the form of nitrous oxide. The absence of nitric oxide and of ferrous iron from the products of this decomposition shows that the ferrous iron has reduced the nitric oxide to nitrous oxide, thus: $2FeO + 2NO = Fe_2O_3 + N_2O$. All the authors' observations are in accord with the view that the iron present in these nitrosulphides exists in the ferrous condition. Cambi's results (see this vol., ii, 288) are discussed. T. H. P.

The Utilisation of Native Iron-Aluminium Phosphates. Heinrich Schröder (D.R.-P. 192591).—A mixture of iron-aluminium phosphate and calcium and magnesium chlorides is ignited, when aluminium chloride sublimes, and is collected in a cold concentrated solution of sodium chloride, where it forms the double sodium-aluminium chloride. The ferric chloride which subsequently sublimes is collected in a special receiver; the residue is worked up for phosphate soluble in citric acid. G. T. M.

Reducing Power of Ferropyrophosphates. P. Pascal (*Compt. rend.*, 1908, **146**, 862—864. Compare this vol., ii, 193).—Solutions containing the alkali ferropyrophosphates reduce gold and silver salts in the cold; platinum salt solutions are not reduced even on boiling. In the case of dilute solutions, the reduced gold and silver are in the colloidal condition, and are so strongly coloured that the reaction may be made the basis of a colorimetric method for the estimation of the metals.

Mercuric salts are reduced to mercurous, and then to mercury; in dilute solutions, the mercury is obtained as a colloidal solution, which has a maroon colour by transmitted, and a grey colour by reflected, light.

From cupric salt solutions, a colloidal cuprous hydroxide solution is obtained, which is yellow by transmitted, and green by reflected, light. The production of this yellow colour furnishes a very sensitive test for copper.

After some days, the yellow colour becomes darker, and the cuprous hydroxide is reduced to metallic copper. At 100°, the copper is deposited on the glass as a thin film. H. M. D.

Freezing-point Diagram of the Cobalt Sulphides. K. Friedrich (*Metallurgie*, 1908, 5, 212—215).—Mixtures containing from 0% to 33·6% sulphur have been investigated.

Practically pure cobalt separates from alloys rich in cobalt, the freezing-point curve falling to a eutectic point at 26·6% S and 879°. It then rises to a maximum at 935° and 29·3% S, corresponding with the compound Co_4S_3, the existence of which appears to be established. This compound forms solid solutions containing up to 72·3% of cobalt. The form of the equilibrium diagram also points to the existence of a compound CoS, but alloys of this composition lose sulphur under the ordinary pressure. At lower temperatures, a compound, Co_6S_5, also appears to exist.

The mixtures become porous as the sulphur is increased. The colour changes progressively through the series from cobalt-white to a bronze-like yellow. Only alloys containing more than 68·7% of cobalt are attracted by the magnet. C. H. D.

Behaviour of the Potassium Chromates at High Temperatures. Erich Groschuff (*Zeitsch. anorg. Chem.*, 1908, **58**, 102—112).—Potassium chromate, m. p. 971°, exists in two crystalline modifications, the transition temperature being at 666°. The α-form, stable above that temperature, is completely miscible with α-potassium sulphate (hexagonal), the β-form with β-potassium sulphate, and neither the freezing point nor transition curve shows maxima or minima. The change of colour shown by the β-chromate on heating does not appear to be connected with the transition, as it is gradual, and is evident even at 260°.

Chromic acid melts with slight decomposition at about 196°, and it is probable that the true melting point is still higher. Attempts to obtain freezing-point curves of mixtures of chromic acid and potassium chromate containing more than 50 mol. % of CrO_3 were unsuccessful, owing to the decomposition of the former on heating. Potassium dichromate suffers considerable decomposition on heating at the melting point of the monochromate.

The freezing-point curve of mixtures of potassium chromate and dichromate was determined in the usual way, the mixtures being heated in a nickel resistance furnace. The curve falls regularly from the melting point of the chromate to a eutectic point at 393°, the mixture containing 99% of the dichromate, and then rises to the melting point of the latter, 396°. At the transition temperature, $\alpha\text{-}K_2CrO_4 \rightleftharpoons \beta\text{-}K_2CrO_4$, 666°, the mixture contains about 75·5% of the dichromate. G. S.

Anhydrous Molybdates. I. Erich Groschuff (*Zeitsch. anorg. Chem.*, 1908, **58**, 113—119).—Molybdic anhydride, MoO_3, melts without decomposition at 791°. The observation of Boeke (Abstr., 1906, ii, 750) that anhydrous sodium molybdate, Na_2MoO_4, exists in four modifications is confirmed.

The freezing-point curve of mixtures of sodium molybdate and molybdic anhydride shows a well-defined maximum, corresponding with the composition of sodium dimolybdate, $Na_2Mo_2O_7$ (prismatic crystals), m. p. 612°, and two eutectic points at 551° and 73 mol. % and 495° and 24·5 mol. % of sodium molybdate respectively. G. S.

Determination of the Molecular Weight of Uranous Oxide. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1908, 163—164).—The determinations were made by decomposing uranyl chloride, UO_2Cl_2, by means of a current of hydrogen. The results obtained ranged in one set of experiments between 270·1 and 270·4. In others, numbers lying between 271 and 272 were obtained. T. A. H.

Colloidal Zirconium. Edgar Wedekind [with S. Judd Lewis] (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 289—293. Compare Abstr., 1905, ii, 596).—Colloidal zirconium (Berzelius) was prepared by heating potassium zirconium fluoride with potassium in a special apparatus in absence of air, the product was washed successively with warm alcohol and warm water, then treated with dilute hydrochloric acid, and successive quantities of water added to it on a filter. At first an acid solution passed through, but later a neutral colloidal solution of the metal was obtained. When the precipitate no longer yielded a colloid on washing, this property could be re-imparted to it by renewed treatment with acid.

The colloidal solution thus obtained is greyish-white by transmitted, and black and opalescent by reflected, light; it is relatively stable towards acids, but is reprecipitated by alkalis and by salts which become alkaline by hydrolysis. The effect of a large number of electrolytes on the stability of the solution is described. The particles are positively charged. The appearance of the solution when examined with the ultramicroscope is very much like that of colloidal platinum.

The product is by no means pure, containing more or less oxide. When prepared by the original method of Berzelius, it only contains about 36% of the metal and much oxide, but by a modified method a product containing up to 70% of the metal was obtained. G. S.

Sulphur Compounds of Thorium. André Duboin (*Compt. rend.*, 1908, **146**, 815—817).—Thorium chloride containing a trace of the oxychloride is obtained by passing chlorine mixed with carbon tetrachloride vapour over heated thoria. When a mixture of this chloride with excess of sodium or potassium chloride, contained in a porcelain boat, is heated in a current of dry hydrogen sulphide, the product, after washing out the alkali chloride, consists chiefly of brown, micaceous lamellæ, together with small quantities of yellow crystals and of an amorphous substance. The brown lamellæ, which can be isolated by means of a sieve, are composed of *thorium sulphide*, ThS_2; they act very slightly on polarised light, and have D^0 6·7. By treating the siftings with nitric acid at 40°, the brown lamellæ are violently attacked and dissolved, leaving the yellow crystals, which are only acted on very slowly. The latter consist of *thorium oxysulphide*, ThOS; they are uniaxial and optically negative, and have D^0 8·42.

E. H.

Vanadium-Iron Alloys. Rudolf Vogel and Gustav Tammann (*Zeitsch. anorg. Chem.*, 1908, **58**, 73—82).—The alloys used in the investigation were prepared by an alumino-thermal method. As it was found impossible to obtain alloys rich in vanadium by fusing the latter with alloys rich in iron, the former alloys were prepared by alumino-thermal reduction of mixtures of ferric oxide and vanadium pentoxide in a crucible, the interior of which was lined with so-called "fusible" magnesia. When the lining was not used, the mixture dissolved about 7% of silicon from the walls of the vessel, and these impure alloys were also investigated. The higher temperatures were determined with a Wanner pyrometer.

The freezing-point curve of the almost pure alloys of iron and vanadium falls from the melting point of iron to a minimum at 32%

of vanadium, and then rises to the melting point of the latter element (1750 ± 30°). Except at the minimum, the crystallisation intervals are considerable, and, as the alloys are homogeneous throughout, the metals form a complete series of mixed crystals. The behaviour of the alloys containing silicon is considerably more complicated; the minimum on the freezing-point curve is lower, and at 1380° there is a break in miscibility from 55 to 90% of vanadium. In the alloys containing 20 to 52% of vanadium, there is a transition between 1100° and 1250°, the nature of which has not been elucidated.

The vanadium steels, except those very rich in iron, are hard and fairly brittle, but can be filed and hammered. The presence of silicon greatly increases the hardness and brittleness. Pure vanadium–iron alloys are acted on by nitric acid, but those containing silicon only by hot aqua regia. G. S.

Decomposition of Antimony Hydride. ALFRED STOCK, EUSEBIO ECHEANDIA, and PAUL R. VOIGT (*Ber.*, 1908, **41**, 1309—1318. Compare Abstr., 1907, ii, 180, 181).—The earlier investigation was carried out at 25°, and the present paper deals with the decomposition at 0°, 50°, and 75° in order to test whether the adsorption equation $M = aC^p$ also held good for these temperatures and also to ascertain if the constant, p, increased with the temperature to approximately unity, or if the quantity absorbed, M, becomes proportional to the concentration of the hydride, C. The alteration in the velocity of decomposition may be represented by the equation $\Lambda = 1/C_t^{1-p}$, t being the time.

The experiments were carried out in the same manner as before, the only alteration being the substitution of a mirror scale for the cathetometer, as at the higher temperatures employed rapid decomposition and therefore rapid alterations in pressure occurred. The correction for the departure from Boyle's Law due to molecular attraction at 760 mm. was found to be 13·2 mm. at 0°, 10·8 mm. at 25°, 8·2 mm. at 50°, and 6·2 mm. at 75°.

From the values obtained, the following conclusions are drawn: (1) that the alteration in the velocity of the reaction found at all four temperatures is in agreement with the equation $\Lambda = 1/C_t^{1-p}$; (2) that the constant p increases with rise in temperature, and (3) that the observed phenomena are in agreement with the view that the decomposition occurs in the adsorption layer.

The temperature-coefficients for 0—10°, 30—40°, and 60—70° have been calculated to be 2·05, 1·80, and 1·66. W. R.

Compounds of Antimony Sulphate with Metallic Sulphates. AUGUST GUTMANN (*Arch. Pharm.*, 1908, **246**, 187—190. Compare Abstr., 1899, ii, 33; Metzl, Abstr., 1906, ii, 174; Weinland and Kuhl, Abstr., 1907, ii, 626—627).—Double sulphates of antimony and the commoner alkali metals have already been described (*loc. cit.*), and in the present paper compounds of the same type containing the rarer alkali metals lithium, rubidium, cæsium or silver, and thallium are described. They are obtained by adding antimony oxide to a solution of the sulphate of the other metal in dilute sulphuric acid, have the general formula $SbM'(SO_4)_2$, crystallise for the most part in colourless needles, and are slowly decomposed by water, yielding basic salts. T. A. H.

Action of Sugars on Gold Chloride Solutions. Ludwig Vanino (*Chem. Zentr.*, 1908, i, 446—447; from *Zeitsch. Chem. Ind. Kolloide*, 1907, 2, 51—53. Compare Abstr., 1906, ii, 618).—In diffused daylight the addition of $AuCl_3,HCl,2H_2O$ to a dilute sugar solution causes a blue coloration, owing to inversion of the sugar and formation of colloidal gold. This change takes place more slowly in the dark, and when illuminated by a mercury lamp a violet colour is rapidly produced, metallic gold separating on the surface. When warmed, the violet colour first produced changes to red, whilst in presence of larger quantities of gold a permanent violet-blue colour is obtained. Sodium hydroxide gives a red coloration, whilst acids cause the gold to separate in the ordinary form. $AuCl_3,NaCl,2H_2O$ produces slightly different colorations. Twice distilled, sterilised water was used, ordinary distilled water being found to reduce gold solutions. J. V .E.

Platinum-Thallium Alloys. L. Hackspill (*Compt. rend.*, 1908, **146**, 820—822).—Spongy platinum thrown on to the surface of fused thallium dissolves as easily as in fused lead. The melting point of the resulting alloy does not exceed that of thallium until the proportion of platinum reaches 10%, but as the amount increases to 48·8% it rises to 685°. As the proportion of platinum is further increased, the m. p. at first falls slightly, but then rises continuously, reaching 855° for 65% and afterwards exceeding 1000°. Micrographic examination of the alloys rich in thallium shows that they consist of very brilliant white crystals, easily polished, surrounded by a darker, very soft eutectic. As the composition approximates to the formula TlPt (48·8% Pt), the number and size of the crystals increase until they constitute the entire alloy. Alloys still richer in platinum are susceptible of a higher polish; their surface appears homogeneous, but their composite character is shown on oxidation in a Bunsen flame.

The alloy PtTl is obtained in the form of steel-grey, prismatic needles by the gradual action of nitric acid (10%) on alloys containing less than 10% of platinum. It has D^{14} 15·65; hardness 3 (Mohs' scale); m. p. 685°, and specific heat, 0·0450. It loses a little thallium on continued heating above the melting point, but does not give pure platinum even on prolonged fusion in the oxyhydrogen flame. The alloy is attacked by the halogens, and dissolved by warm aqua regia; the latter on boiling, however, gives the insoluble thallium platinichloride. It is not attacked by hydrochloric acid, and only superficially acted on by sulphuric and nitric acids and by potassium hydrogen sulphate. It resists the action of the fused alkali carbonates, and is only very slowly attacked by sodium peroxide. It dissolves easily in fused zinc, lead, or silver, and forms an amalgam with mercury. Its quantitative analysis, rendered very difficult by its properties, was effected by cupellation with four times its weight of silver and three times its weight of lead.

The compound PtTl is very similar, especially in its physical properties, with the alloy PtPb (Doerinckel, Abstr., 1907, ii, 785).

E. H.

Mineralogical Chemistry.

Origin of Jet. Percy E. Spielmann (*Chem. News*, 1908, **97**, 181—183. Compare *ibid.*, **94**, 281).—Determinations of the heating values and chemical composition lead the author to the conclusion that jet must be classed with cannel coal rather than with lignite. When jet is extracted with carbon disulphide, about 7% of a thick, dark brown oil, smelling like petroleum, is obtained. Having this in mind, the suggestion is made that the particles of jet may be surrounded by a film of the petroleum-like substance, causing the difference between the electrifying power of jet and that of cannel coal. The attempt of McIntosh (*Chem. News*, 1906, **94**, 314) to connect closely jet and amber is criticised.

J. V. E.

Stephanite Crystals from Arizpe, Sonora, Mexico. William E. Ford (*Amer. J. Sci.*, 1908, [iv], **25**, 244—248).—A description is given of some large crystals, 2—3 cm. across, and of some smaller twinned crystals with a rich development of faces. Analysis agrees with the usual formula $5Ag_2S,Sb_2S_3$.

Ag.	Sb.	S.	Total.
68·36	15·30	16·33	99·99

L. J. S.

Helium in Minerals Containing Uranium. Fréd. Bordas (*Compt. rend.*, 1908, **146**, 896—898. Compare this vol., ii, 430).—By employing the method already described, the author finds that uraniferous minerals do not lose helium until heated above 250°. It is thus possible to remove moisture from the finely-divided mineral without incurring appreciable loss of helium. This gas was found to be absent in some highly radioactive pitchblende which had been kept in closed bottles for several years; chemical analysis, moreover, failed to detect uranium in these specimens. Helium was found in abundance, associated with uranium, in samarskite, euxenite, naëgite, yttrotantalite, and annerödite. In less abundance it was present in wöhlerite, pyrochlore, polycrase, trögerite, xenotime, gummite, thorite-orangite, and niobite-columbite. Minerals containing well-defined or crystalline salts of uranium do not liberate helium. Examples of this class are torbernite, autunite, and carnotite. Helium has been characterised by the line $d = 5878$ in native bismuth from Saxony.

W. O. W.

Physicochemical and Mineralogical Investigations of the Occurrence of Bromine and Iodine in the Potassium Salt Deposits. H. E. Boeke (*Sitzungsber. K. Akad. Wiss. Berlin*, 1908, 439—441).—The part played by bromides and iodides in the crystallisation of the halogen salts of sodium, potassium, and magnesium has been examined.

Magnesium chloride and magnesium bromide hexahydrates form a complete series of mixed crystals; potassium chloride and bromide exhibit the same phenomenon. Carnallite and bromo-carnallite both belong to the rhombic system, but show considerable crystallographic differences. They represent an isodimorphous pair, for which the interval between the two series of crystals is very small. At 25°, a solution in which the molecular ratio of the bromine compound to the sum of the bromine and chlorine compounds is 0·302 is in equilibrium with the two kinds of mixed crystals.

Sodium chloride shows little tendency to form mixed crystals with sodium bromide, but from a solution in which the molecular ratio of bromide to the sum of bromide and chloride is greater than 0·82, mixed crystals of the dihydrated salts are obtained which are isomorphous with sodium bromide dihydrate.

The formation of mixed crystals containing potassium chloride and bromide and crystals containing carnallite and bromocarnallite is not influenced by the presence of large quantities of sodium chloride. The presence of considerable quantities of magnesium chloride increases the tendency of sodium chloride and potassium chloride to take up the corresponding bromides from solution.

These results agree with the observation that the percentage of bromide in the different Stassfurt layers is approximately proportional to the quantity of carnallite present. The chlorides above mentioned do not yield mixed crystals with the corresponding iodides. The iodide present in the Stassfurt mother liquors must therefore have accumulated in these and have been decomposed by oxidation in contact with the air. H. M. D.

Decomposition of Dolomite. NICHOLAS KNIGHT (*Chem. News*, 1908, **97**, 217).—The dolomite of Iowa and other sections of the country belonging to the Niagara period of the Upper Silurian undergoes disintegration where exposed to air. The following figures were obtained on analysis of the massive (I) and the disintegrated (II) rocks:

	SiO_2.	Fe_2O_3.	Al_2O_3.	$CaCO_3$.	$MgCO_3$.	Total.
I.	0·83	0·34	0·25	53·62	44·96	100·00
II.	0·56	0·74		48·43	50·56	100·09

The disintegrated rock is overlaid by a clay, which has probably been formed by further slow decomposition of the dolomite. Analysis gave:

SiO_2.	Fe_2O_3.	Al_2O_2.	CaO.	MgO.	H_2O.	Total.
16·68	60·87	6·18	0·22	0·03	17·14	101·12

G. Y.

Manganese Ore Deposits of the Queluz District, Brazil. ORVILLE A. DERBY (*Amer. J. Sci.*, 1908, [iv], **25**, 213—216).—The extensive deposits of manganese ore (psilomelane?) in the Queluz district of Minas Geraes were formerly considered by the author

(Abstr., 1901, ii, 558) to have been derived by the weathering of rocks rich in manganese garnet (spessartite). A recent visit to the quarries, after the surface material has been removed, proves, however, that the rock from which the black manganese oxide has been derived consists largely of manganese carbonate. This is a dark-coloured rock (anal. I and II by E. Hussak) resembling a limestone, and consisting of rhodochrosite (?), tephroite, and spessartite, with a little rhodonite:

	CO_2.	SiO_2.	MnO.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.
I.	22·62	11·80	47·52	7·50		3·76	6·27
II.	4·59	27·67	57·48	1·41	2·48	1·82	4·60

L. J. S.

Two New Boron Minerals of Contact-Metamorphic Origin. A. KNOPF and WALDEMAR T. SCHALLER (*Amer. J. Sci.*, 1908, [iv], 25, 323—331).—The Alaskan deposits of tin ore, situated in the extreme western part of the Seward Peninsula, are genetically associated with granitic masses intrusive into limestones; the latter have been intensely metamorphosed by contact and pneumatolytic action, with the production of tourmaline and various other minerals, including the two new species now described.

Hulsite occurs abundantly with idocrase, magnetite, garnet, and fluorite in a matrix of coarse, white calcite; it has a black colour and streak with a strong sub-metallic lustre, and is opaque; the tabular crystals are probably orthorhombic, and possess a good prismatic cleavage, the cleavage angle being 57° 38′; D 4·28, H 3. The mineral is readily soluble in hydrochloric acid and in hydrofluoric acid, and it is readily fusible before the blowpipe.

Anal. I of pure non-magnetic material corresponds with the formula $7(Fe,Mg)O,Fe_2O_3,H_2O,4B_2O_3$, and II is the mean of several analyses of material intimately intergrown with about 20% of magnetite. In these analyses, the iron was determined volumetrically, since when precipitated for gravimetric determination it carries down some of the boric acid; it was also found that, when the mineral is ground to a fine powder, some of the ferrous iron is oxidised, and the material absorbs water from the air:

	FeO.	MgO.	Fe_2O_3.	H_2O.	B_2O_3.	Insol.	Total.
I.	33·27	10·17	17·83	[1·81]	[27·42]	10·00	100·00
II.	34·44	8·48	27·64	1·66	25·27	2·24	99·73
III.	44·48	1·44	16·72	2·03	20·89	14·35	99·91

Paigeite occurs with tourmaline, fluorite, idocrase, mispickel, &c., in the metamorphosed limestone. It is coal-black, lustrous, and opaque, and presents the form of matted fibres and long needles with a foliated appearance; D 4·71, H 3. The mineral is readily soluble in hydrochloric acid and in hydrofluoric acid. Anal. III corresponds with the formula $6(Fe,Mg)O,Fe_2O_3,H_2O,3B_2O_3$.

The two minerals, although very similar in composition, are strikingly different in physical characters. Related minerals are ludwigite ($4[Fe,Mg]O,Fe_2O_3,B_2O_3$), pinakiolite, and warwickite. L. J. S.

Tungstite and Meymacite. THOMAS LEONARD WALKER (*Amer. J. Sci.*, 1908, [iv], 25, 305—308).—A heavy, golden-yellow mineral with a resinous lustre, and apparently an alteration product of wolframite, occurs in veins of gold quartz near Salmo, in British Columbia. It is traversed by darker-coloured veins, and encloses specks of gold and other impurities. Minute crystals from cavities possess a perfect cleavage in one direction, perpendicular to which is a bisectrix of the optic axes. The portion of the material dissolved by ammonia or sodium hydroxide contains 80·08% WO_3, and a bulk analysis gave:

WO_3.	CaO.	FeO.	Fe_2O_3.	H_2O.	Total.
86·20	0·54	[1·21]	4·14	7·72	99·81

This corresponds with 86·29% WO_3,H_2O, together with some scheelite, wolframite, and limonite. The sp. gr. calculated for the pure material is 5·517.

These results indicate that the mineral is related to the meymacite of A. Carnot (1874), for which the formula is given as $WO_3,2H_2O$ (although the water shown in the three analyses varies from 6·85 to 12·93%, and 6% Fe_2O_3 is present). It is pointed out, however, that the tungstite of B. Silliman (1822) has never been analysed, and that the crystallographic constants quoted for this refer to the artificial anhydrous oxide. It is therefore suggested that tungstite and meymacite are identical, being hydrated tungstic oxide, and that the former name be the one adopted. L. J. S.

Barytes from the Binnenthal, Switzerland. Heinrich Baumhauer and Charles Otto Trechmann (*Zeitsch. Kryst. Min.*, 1908, **44**, 609—617).—Crystallographic descriptions are given of four types of crystals of barytes from the white, crystalline dolomite of the Binnenthal. Crystals of one of these types resemble those described by Neminar, in 1876, as "barytocelestite." These contain 98·15% $BaSO_4$, and on ignition there was a loss of 1·324%, due to the presence of liquid enclosures; no trace of strontium is present. The existence of barytocelestite at this locality is very doubtful. L. J. S.

A New Mineral from the French Congo. Alfred Lacroix (*Compt. rend.*, 1908, **146**, 722—725).—Associated with the crystals of dioptase from Mindouli, in the French Congo, is a blue, fibrous copper silicate, which forms botryoidal masses or fibrous veins in limestone. The fibres are optically biaxial and apparently positive, and extinguish parallel to their length. Analysis by F. Pisani gave:

SiO_2.	CuO.	FeO.	H_2O.	Total.	Sp. gr.
37·16	59·20	trace	4·50	100·86	3·36

This gives the formula $5H_2O,15CuO,12SiO_2$, which may be written as a basic metasilicate, $H_2(CuOH)_8Cu_7(SiO_3)_{12}$. The water is expelled only at a red heat. The new mineral, for which the name *plancheite* is proposed, also differs from dioptase in being more difficultly decomposed by acids and without the separation of gelatinous silica.

The copper deposits at Mindouli consist of masses and veins of argentiferous copper-glance in limestone; near the surface, various secondary minerals, malachite, dioptase, native silver, chrysocolla, cuprite, cerussite, wulfenite, pseudomalachite, pyromorphite, &c., are present. L. J. S.

Physiological Chemistry.

Cutaneous Respiration. GIUSEPPI FRANCHINI and LUIGI PRETI (*Biochem. Zeitsch.*, 1908, **9**, 442—452).—Experiments were carried out on the arms and hands of the investigators. The parts of the body under investigation were enclosed in a cylinder containing oxygen. The apparatus was so arranged that the amount of gas at the beginning and the end of the experiments, which lasted one hour, could be accurately estimated. The gas was analysed both at the beginning and the end, and the absorbed oxygen and excreted carbon dioxide determined. It was estimated that the whole body absorbs at 36° 5·5 litres of oxygen in twenty-four hours, that is, about 1% of the quantity absorbed in pulmonary respiration. The amount of carbon dioxide excreted was calculated to be 4·8 litres, also about 1% of that due to pulmonary respiration. S. B. S.

Respiratory Metabolism of the Isolated Spinal Cord of the Frog. HANS WINTERSTEIN (*Zentr. Physiol.*, 1908, **21**, 869—873).—The fresh spinal cord of the frog was stimulated in Thunberg's micro-respirometer, and found to have a high respiratory exchange; per unit of weight, it is two to three times greater than that of the body as a whole. Strychnine poisoning causes no increase. W. D. H.

Nature of the Combination of Gases in Blood and its Constituents. Preliminary Notice. WOLFGANG OSTWALD (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 294—301).—On the basis of the experimental data of Loewy and others, it is shown that for the taking up of carbon dioxide by solutions of hæmoglobin and by blood, and of oxygen by blood, the laws of absorption are closely followed, and the conclusion is therefore drawn that the fixation of gases by blood and its constituents is mainly a physical process, connected with the large surface of the colloidal particles. G. S.

Blood-formation in Spleen and Liver in Experimental Anæmia. A. VON DOMARUS (*Arch. exp. Path. Pharm.*, 1908, **58**, 319—342).—By protracted poisoning with phenylhydrazine, pyrogallol, &c., organic changes are produced in rabbits which resemble those seen in pernicious anæmia in man. These changes (in bone marrow, spleen, blood corpuscles, &c.) do not occur in acute poisoning; they are most marked in embryonic animals, and are an expression of the inability of the blood-forming organs to cope with the increased destruction of blood corpuscles. W. D. H.

Are the Antigen and the Amboceptor-fixing Substance of the Blood Corpuscles Identical? J. Forssman (*Biochem. Zeitsch.*, 1908, **9**, 330—352).—According to Ehrlich's theory, the amboceptor-fixing substance, and the substance which on injection produces hæmolysis (antigen), should be identical. This is not in accord with the results obtained previously by Bang and Forssmann. Experiments were therefore carried out to separate the antigen from the amboceptor-fixing substance. The former appears to be simpler than the latter, as it resists heating. It was thought therefore that separation might be accomplished by dialysis. To test this hypothesis, blood-stromata of ox were suspended in saline, and the mixture enclosed in a collodium capsule, which was implanted in the peritoneal cavity of a rabbit. Several such experiments were carried out, but only in a certain number of cases was a hæmolytic serum produced. In all these cases it was found that the contents of the capsule had become contaminated with bacteria, which apparently caused the separation of the antigen from the stromata; the former dialysed through the capsule and produced the lysin. A similar result could be produced from sterile capsules by the addition of steapsin. In some cases, where the capsule had remained for a sufficient length of time in the peritoneum, the contents lost their hæmolysin-producing powers (as tested by injection into another rabbit), and the antigen had entirely dialysed out. The residue, however, when treated with a mixture of inactivated (by heat) hæmolytic serum (amboceptor) and normal serum (complement) deprived this of its hæmolytic power; the centrifuged solid stromata became strongly hæmolytic, and these had combined with the amboceptor. The antigen and amboceptor-fixing substances are therefore not identical. S. B. S.

Decomposition of Blood Platelets, Blood Coagulation, and Muscle Coagulation. K. Bürker (*Chem. Zentr.*, 1908, i, 537; from *Zentr. Physiol.*, 1907, **21**, 651).—The statement of Pflüger (*Pflüger's Archiv*, 1904, **102**, 36) that the breaking down of blood platelets is determinative of blood coagulation, and the fate of the other constituents of the blood have been investigated. By investigating the influence of the same substance on muscle coagulation, it is shown that parallel with the effect on the decomposition of blood platelets and the blood coagulation there is an increased stimulation of the muscle.

J. V. E.

The Behaviour of Certain Polypeptides towards the Red Corpuscles and Platelets of Ox-Blood. Emil Abderhalden and Wilfred H. Manwaring (*Zeitsch. physiol. Chem.*, 1908, **55**, 377—383).—The red corpuscles were obtained free from plasma by washing with salt solution in the centrifuge. The platelets were obtained by fractional centrifugalisation. The results agree with those previously obtained with horses' blood (Abstr., 1907, ii, 889). Irregular results given by the platelets are attributed to the difficulty experienced in obtaining them pure. W. D. H.

Researches in Phagocytosis. Hartog J. Hamburger and Ebel Hekma (*Biochem. Zeitsch.*, 1908, **9**, 275—306. Compare Abstr., this vol., ii, 205).—Loeb found that pure sodium chloride had a poisonous action on the eggs of certain marine animals, but this is not so for phagocytes in a 0·9% solution of the salt; phagocytosis is about equally active in this solution and in serum. Diminution of the hydroxyl ions in serum by adding acid depresses phagocytosis; increase beyond a certain point has the same effect. In solutions of sodium chloride, these effects are more marked. Fluorine, citric acid ions, and sulphurous acid ions are harmful. Potassium chloride also lessens phagocytosis, the leucocytes being permeable to potassium ions. Calcium ions favour phagocytosis; an addition of 0·005% calcium chloride increases it by 22%. W. D. H.

The Biology of Phagocytes. Influence of Hæmoglobin, &c., on Phagocytosis. HARTOG J. HAMBURGER and EBEL HEKMA (*Biochem. Zeitsch.*, 1908, **9**, 512—521).—The phagocytic power was determined by estimating the percentage of the leucocytes in serum or aqueous suspension which had taken up added charcoal particles. It was found that free hæmoglobin in concentrations greater than actually occur in life (in pathological cases) exerts no action on the phagocytic power. Crédé colloidal silver, in concentrations of 0·02% and more, exerts an inhibitory influence. Quinine also exerts a marked inhibitory influence, even in concentrations of 0·005%. This observation is of practical importance, as the administration of 1 gram of quinine hydrochloride can occasion a blood-content of 0·01% of the salt. The serum of a different species from that from which the leucocytes have been obtained can also diminish the phagocytic action. Urea, even in 2% concentration, is without influence. S. B. S.

The Behaviour of Certain Polypeptides towards the Plasma of Ox-Blood. EMIL ABDERHALDEN and JAMES S. McLESTER (*Zeitsch. physiol. Chem.*, 1908, **55**, 371—376).—Oxalate plasma was prepared from ox-blood and freed from formed elements by the centrifuge. It does not split glycyl-*l*-tyrosine, although the corpuscles do so. If, however, the plasma contains hæmoglobin, splitting of the dipeptide occurs. The plasma splits *dl*-alanylglycine, diglycylglycine, and glycyl-*dl*-alanine; the last-named dipeptide is only split in small measure; the plasma of the horse does not split it at all. W. D. H.

The Influence of Resorbed Salicylic Acid on the Opsonic Functions of the Serum. MARTIN JACOBY and ALBERT SCHÜTZE (*Biochem. Zeitsch.*, 1908, **9**, 527—532).—The experiments were carried out with leucocytes of guinea pig, a bouillon suspension of typhus culture, and serum of rabbit. A comparison was always made with the serum of the same animal before and after administration of salicylic acid. The phagocytic action in each case was determined by making film preparation of the centrifuged leucocytes, after they had remained with the serum and the suspension of typhus culture. It was found in most cases that the administration of salicylic acid caused an increase of phagocytic power, that is, it increased the opsonic power of the serum. S. B. S.

The Action of Resorbed Salicylic Acid in Blood Serum. MARTIN JACOBY (*Biochem. Zeitsch.*, 1908, **9**, 522—532).—Salicylic acid after ingestion *per os* appears in large quantities in the blood. It seems to have entered into some form of combination with the serum proteins. If the serum from an animal to which salicylic acid has been administered is half saturated with ammonium sulphate, the precipitate which is formed carries down with it only a small trace of the acid; on complete saturation with the salt, a second precipitate is obtained which contains nearly all the salicylic acid. If, however, salicylic acid is added to a normal serum, it does not appear in the precipitate produced by complete saturation with ammonium sulphate, but in the filtrate. These facts indicate that the ingested salicylic acid is removed from the digestive tract by entering into combination with serum proteins. It can be set free from this combination by the action of acids. Diluted serum from an animal to which salicylic acid has been administered gives on boiling a precipitate which contains very little salicylic acid; the filtrate from this precipitate on acidification with acetic acid gives a precipitate, however, which is rich in salicylic acid. S. B. S.

The Amount of Albumose in Blood. ERNST FREUND (*Biochem. Zeitsch.*, 1908, **9**, 463—488).—A continuation of the controversy with Abderhalden (see this vol., ii, 117, 305). S. B. S.

The Lysinogen of the Blood-disks. KENJI TAKAKI (*Beitr. chem. Physiol. Path.*, 1908, **11**, 274—287).—Bang and Forssman found that by extracting blood corpuscles or their stromata with ether, a substance is extracted which produces hæmolysis when injected into animals, and the immune substance there developed is identical with that obtained by injection of blood corpuscles. The lysin-yielding material (lysinogen) is most easily dissolved by boiling acetone, in which it remains dissolved after cooling. Bang and Forssman stated that the material is not a protein, and they were unable to identify it with any known phosphatide or cerebroside. The present paper is a further attempt to identify it, and describes its solubilities in various reagents; the raw material contains 35% of ash. It gives a positive Molisch reaction, and dissolves most easily in decinormal alkali, but is not precipitated by neutralisation. If, however, alkali is used for extracting it directly from the corpuscles, neutralisation produces a precipitate of protein which apparently carries down the lysinogen with it, for the filtrate is inactive. The material in question is certainly not a protein; it contains phosphorus and a carbohydrate group; it is probably a lipoid, but cannot be identified with any known phosphatide. W. D. H.

The Chemical Hæmolysins. IV. Acids. ALBERT J. J. VANDEVELDE (*Bull. Soc. chim. Belg.*, 1908, **22**, 147—154. Compare Abstr., 1907, ii, 792; this vol., ii, 49).—The hæmolytic powers of the twenty-four acids examined are by no means in the same order as their strengths; some weak organic acids produce hæmolysis at a lower normality than the strongest mineral acids. In the fatty series, the hæmolytic power decreases from formic to propionic acid, and then increases again; formic acid is an especially powerful hæmolysin.

G. B.

Influence of Certain Proteins and other Colloids on Hæmolysis. Kurt Meyer (*Arch. Hygiene*, 1908, 65, 292—304).—The inhibition, by serum, of the hæmolytic action of soaps (von Liebermann, Abstr., 1907, ii, 973; Noguchi, Abstr., 1907, ii, 974) and of bile-salts is due to the proteins in the serum. Hæmolysis by saponin is not inhibited by these proteins, but is, on the other hand, prevented by cholesterol, which does not inhibit hæmolysis by soaps and by bile-salts. In their inhibitory action, the serum-albumin and -globulin cannot be replaced by other colloids, or even by other proteins, such as edestin, caseinogen, or egg-albumin; the inhibition does not depend on any reduction of the power of soap or bile-salts for dissolving lipoid. At high concentrations, dextrin, gum, and gelatin agglutinate red blood-corpuscles, and thus render them more susceptible to hæmolysis. G. B.

The Influence of Temperature on Motor and Sensory Nerves of the Frog. Max Hafemann (*Pflüger's Archiv*, 1908, 122, 484—500).—The death temperature of nerves in cold-blooded animals is placed by Alcock at 42°; this is lower than in warm-blooded animals, and is the temperature at which the electrical "sign of life" disappears. Brodie and Halliburton, in their study of heat contraction in nerve, found similar differences in the two groups of animals; in the frog, 40—42° is the temperature at which the first step in contraction occurs, and coincides with the coagulation temperature of the first protein in nervous tissues. Miram placed frogs' nerves in Ringer's solution, and estimated the death temperature by the disappearance of excitability as judged by the absence of contraction in the attached muscles when the nerve was stimulated. He found 47° to be the temperature at which this disappeared, and associates death with the coagulation of the second protein in nerve structures.

In the present research, the frog's sciatic nerve immersed in Ringer's solution was also employed; the temperature of this was raised, and the nerve stimulated at intervals; the attached gastrocnemius finally ceased to contract, and the fatal temperature for motor fibres was thus determined. Similar determinations in the case of the sensory fibres were made by keeping the nerve attached to the spinal cord, and recording the contraction of the gastrocnemius of the opposite side. The conclusions drawn are that a temperature of 42° leaves the conductivity of both kinds of nerve fibre intact; a temperature of 50° is fatal to both; temperatures of 44—48° are fatal to sensory, but not to motor, nerves. W. D. H.

Influence of Certain Food-adjuncts on the Action of the Digestive Enzymes. K. Togami (*Biochem. Zeitsch.*, 1908, 9, 453—462).—The influence of infusions of tea, coffee, and chicory on the digestive power of ptyalin, pepsin, and trypsin were investigated, the methods of Wohlgemuth for ptyalin and of Fuld for pepsin and trypsin (edestine hydrochloride digestion) being chiefly employed. The rate of digestion of the enzyme dissolved in the infusion was compared with the rate when dissolved in distilled water. It was found that the infusions in the strength in which they are ordinarily ingested exert no deleterious action on the enzymes. In higher concentrations they (and especially tea) exert an inhibitory influence.

S. B. S.

"Specific Dynamic Action" of Protein. GRAHAM LUSK (*Zentr. Physiol.*, 1908, **21**, 861—862).—Rubner showed that by the administration of proteins, the heat-production of the body is increased by 30 calories for each 100 protein-calories. This is explained as follows: under ordinary conditions, proteins are split into amino-acids in the intestine without any production of heat. If, however, the amino-acids are deamidised, heat is lost; for instance, in the conversion of alanine (4372 cal.) with lactic acid (3661 cal.) there is a loss of 16%. The heat thus formed may not be of importance for the ordinary processes of life. If, however, protein feeding is followed by nitrogenous onput, that part of the protein so utilised has no specific dynamic action, as its amino-acids are not deamidised, but built into the food protein.

W. D. H.

Influence of Amides on Protein Metabolism. KONRAD FRIEDLAENDER (*Pflüger's Archiv*, 1908, **122**, 511—516).—Polemical. A reply to Völtz on this question, and a further contribution to a much prolonged controversy.

W. D. H.

Digestion of Proteins in the Alimentary Canal of the Dog. IV. EMIL ABDERHALDEN, E. S. LONDON, and BERTHOLD OPPLER (*Zeitsch. physiol. Chem.*, 1908, **55**, 447—454).—In observations on dogs with fistulæ, it appears certain that in ordinary digestion, little or no liberation of amino-acids occurs in the stomach, but this does take place in the small intestine. The small yield of these in any particular segment of the intestine is probably explained by rapidity of absorption of the cleavage products; some, however, of the cleavage products which are not completely broken down into the final amino-acids, appear to be absorbed in the duodenum, and the remainder pass down the intestine to undergo more complete cleavage there. Just as in experiments *in vitro*, certain amino-acids (such as tyrosine) are more readily split off from the protein molecule than others (such as glutamic acid). The paper is of a preliminary nature.

W. D. H.

Origin and Destiny of Cholesterol in Animals. I. Hippocoprosterol. II. Excretion of Cholesterol by the Dog. CHARLES DORÉE and JOHN A. GARDNER (*Proc. Roy. Soc.*, 1908, **80**, *B*, 212—226, 227—238).—Many divergent views are held in reference to the physiological significance of cholesterol. Flint was, however, correct in his statement that it is found in human fæces in the form of a material he named stercorin. This was re-discovered by Bondzynski, who termed it coprosterol; it crystallises in long needles (m. p. 95—96°), is dextrorotatory, and gives colour reactions similar to those of cholesterol. It has the formula $C_{27}H_{48}O$; it behaves as a saturated alcohol, and is regarded as a dihydrocholesterol formed by bacterial reduction in the intestine. The hippocoprosterol of horses' fæces has been regarded as a substance of similar origin. The present experiments show, however, that it is not a product of animal metabolism, but a constituent of the grass taken as food; it is passed unchanged by all herbivorous animals fed on grass. Its name is misleading, and the new term *chortosterol* is proposed. It is an alcohol, with the formula $C_{27}H_{56}O$, or more probably $C_{27}H_{54}O$. It gives none of the usual colour reactions. The fæces contain no cholesterol; that in the bile must either be reabsorbed or destroyed. It is therefore difficult to believe that cholesterol is an excrementitious product got rid of in the fæces through the agency of bile.

In the dog fed on either cooked vegetable or meat diet, cholesterol is normally excreted as such. If fed on raw brain, coprosterol only was obtained. Further experiments on the possible absorption of cholesterol in the intestine are in progress. W. D. H.

Relation of Creatine to Autolysis. R. Stangassinger. **Formation and Destruction of Creatine in Perfused Organs.** Rudolf Gottlieb and R. Stangassinger (*Zeitsch. physiol. chem.*, 1908, 55, 295—321, 322—327. Compare Abstr., 1907, ii, 637).—The ferments named creatase and creatinase act best in a weakly acid medium. Toluene used as an antiseptic inhibits them but little. They are inhibited by protoplasmic poisons, and by urea and sodium chloride in high concentration. By the autolysis of liver and blood (dog), creatine is formed at first, especially in well-fed animals. Liver extracts destroy creatinine, and the quantity of creatine is thus markedly increased. The liver and kidneys appear to be the situations where creatine is normally destroyed. By perfusion experiments, it is shown that both creatine formation and creatine destruction occur in the liver. W. D. H.

Acetone Formation in the Liver. III. Gustav Embden and Alfred Marx. **Formation of Acetoacetic Acid in the Liver.** G. Embden and Hans Engel. **Formation of Acetoacetic Acid in the Liver of Diabetic Dogs.** G. Embden and Leone Lattes. **The Destruction of Acetoacetic Acid in the Animal Body. I.** G. Embden and Louis Michaud. **The Behaviour of Isomeric Leucines in the Liver.** G. Embden (*Beitr. chem. Physiol. Path.*, 1908, 11, 318—322, 323—326, 327—331, 332—347, 348—355. Compare Abstr., 1906, ii, 375).—Experiments were performed as in previous work by perfusing the liver with fatty acids, and noting the amount of acetone formed. Comparative figures were as follows: *n*-butyric acid, 128; *n*-valeric acid, 20; *n*-hexoic acid, 100; *n*-heptoic acid, 12; *n*-octoic acid, 60; *n*-nonoic acid, 19; *n*-decoic acid, 58. That is to say, only the acids with an even number of carbon atoms cause any increase in the amount of acetone formed, and the increase diminishes as the number of carbon atoms rises. The acids with an odd number of carbon atoms produce no more increase of acetone than blood by itself does.

Amino-*n*-butyric acid forms no acetone, whereas, as just noted, *n*-butyric acid does. On the other hand, *n*-valeric acid forms no acetone, but its amino-derivative does; amino-*n*-hexoic acid also forms no acetone.

The various substances which lead in this way to acetone formation, also lead to an intermediary production of acetoacetic acid, and presumably of β-hydroxybutyric acid as well.

In dogs rendered diabetic either by extirpation of the pancreas or administration of phloridzin, the liver forms far more acetone than in normal animals. The figures given relate to total acetone, that is, acetone already present *plus* that derived from acetoacetic acid. The latter is, however, the larger fraction of the two, contributing from 76 to 85% of the total. The exact mechanism of the change (increase of ferment action, &c.) is undecided. The animals in question were in a state of inanition, but that by itself is ineffective in producing an increase of acetone formation.

The fresh organs of the body (liver, kidney, spleen, muscle, &c.) in a finely-minced condition, mixed with acetoacetic acid, produce its disappearance if kept in the incubator; acetone also similarly disappears, but only in a small degree. It is possible that this may result in the formation of acetic acid, but methods have yet to be devised to render this a certainty.

d-Leucine acts as an acetone former; the racemic leucine acts in the same way in virtue of its dextrorotatory constituent; the natural *l*-leucine has no such action unless it is given in very large quantities. The view is advanced that the "non-natural" component is not broken down, for, as is well known, the unusual amino-acids are broken down with difficulty in the organism; it is believed to be used synthetically for the formation of acetoacetic acid or acetone. W. D. H.

Can the Liver Form Glycogen from Optically Active Amino-acids? KARL GRUBE (*Pflüger's Archiv*, 1908, **122**, 451—454).—As in a previous research (Abstr., 1907, ii, 565), the tortoise liver was perfused with Ringer's solution, various amino-acids were added to the fluid, and no increase found in the hepatic glycogen; these acids, however, were optically inactive; in the present research, *d*-alanine, *l*-leucine, and glycine were employed with the same negative result. W. D. H.

Creatine and Creatinine in Frog's Muscle. T. GRAHAM BROWN and E. PROVAN CATHCART (*Proc. physiol. Soc.*, 1908, xiv—xv; *J. Physiol.*, **37**).—A small increase in the total creatinine was found in isolated frog's muscles after stimulation. If, however, the muscles are stimulated through the skin, and the circulation is intact, there is a decrease. W. D. H.

Chemistry of Bone-marrow. JOSEPH NERKING (*Biochem. Zeitsch.*, 1908, **10**, 167—191).—The following substances were isolated: hypoxanthine, lactic acid, inosite, serum-albumin, serum-globulin, deuteroalbumose, a nucleo-proteid containing iron, and a pentose group.

Estimations of the water-content, ash, and fat were made. The fat constants both for red and yellow bone-marrow were also determined.
S. B. S.

Skeletal Substances in Anthozoa. III. Cornicrystallin. Carl Th. Mörner (*Zeitsch. physiol. Chem.*, 1908, 55, 223—235. Compare Abstr., 1905, ii, 310).—Various conjectures as to the nature of Krukenberg's cornicrystallin, which he obtained by hydrolysis of the skeletal material of *Gorgonia* and other anthozoa, are all incorrect. The material in question consists of elementary iodine. W. D. H.

Monoamino-acids of Byssus. Emil Abderhalden (*Zeitsch. physiol. Chem.*, 1908, 55, 236—240).—Byssus is the secretion of a gland of certain mussels, which in the air sets into silk-like threads. It is stated that in the past it has been woven into textures. Thirty grams were obtained from *Pinna nobilis*, a quantity which did not allow of quantitative analysis. It is similar to silk fibroin in many points. It yields a good deal of glycine and *l*-tyrosine, also *d*-alanine, *l*-aspartic acid, and proline, probably also valine, leucine, and phenylalanine; tryptophan appears to be absent; the presence of glutamic acid is uncertain. W. D. H.

Chemical Investigations on the Octopus. Martin Henze (*Zeitsch. physiol. Chem.*, 1908, 55, 433—444).—Many organs of the octopus yield pentose, which is believed to originate from a reserve supply of pentosans. The eggs also yield glucosamine. The pentose obtained from the muscles is probably *l*-xylose. The nucleo-protein of the hepato-pancreas contains N, 14·23; P, 0·92; Cu, 0·96, and pentose (*l*-xylose), 5—6%; the same organ contains fats and cholesterol.
W. D. H.

Chemical Composition of the Skeletal Substance of Velella spirans. Martin Henze (*Zeitsch. physiol. Chem.*, 1908, 55, 445—446).—The organic substance in the skeleton of this *siphonophore* is chitin. W. D. H.

Composition of Chrysalis Oil (from Silk-Worms). Mitsumaru Tsujimoto (*J. Coll. Eng. Tokyo*, 1908, 4, 63—74. Compare Lewkowitsch, Abstr., 1907, i, 521).—The unsaponifiable portion (1·63%) is not cholesterol (compare Lewkowitsch, *loc. cit.*), but phytosterol. For the rest, the oil consists of glycerides of fatty acids, of which 25% are saturated (palmitic acid is present, but probably not stearic acid). The 75% of unsaturated acids consist of oleic, linolenic, and *iso*linolenic acids, together with isomerides of linoleic acid. G. B.

Erepsin. Else Raubitschek (*Chem. Zentr.*, 1908, i, 870; from *Zeitsch. exp. Path. Ther.*, 1907, 4, 675—680).—The action of dry powdered intestinal mucus membrane on peptones and various albumins leads to the conclusion that there exists a specific intestinal ferment which gives amino-acids from albumoses, and has no action on natural albumin. This ferment is active in small quantities, requiring about six hours to produce its maximum effect. The addition of substances which pass through the intestine, such as blood, bile, calcium chloride, and sodium sulphate, neither inhibits nor aids the activity of the ferment. J. V. E.

Urinary Secretion in the Frog. WINIFRED C. CULLIS (*Proc. physiol. Soc.*, 1908, xvi—xvii; *J. Physiol.*, **37**).—If a diuretic, such as sodium sulphate, is added to the oxygenated Ringer's solution employed to perfuse frog's kidneys, there is a great increase in the secretion. If the gases are removed from the perfusing fluid, the restriction in oxygen supply leads to a much slower excretion. This favours the view that secretory activity and not mere filtration is the factor concerned. W. D. H.

Lævulose in Diabetic Urine. L. BORCHARDT (*Zeitsch. physiol. Chem.*, 1908, **55**, 241—259).—The most important outcome of the research is that there is no ground for the statement that diabetic urine contains lævulose. The best method of testing for this substance is to boil equal quantities of urine and 25% hydrochloric acid and a fragment of resorcinol in a test-tube for a short time; if a red coloration appears, the mixture is cooled under the tap, poured into a beaker, made alkaline with sodium carbonate, returned to the test-tube, and shaken with ethyl acetate. If lævulose is present, the ethyl acetate becomes yellow. Many mis-statements about lævulose in urine are due to want of care in testing for it. W. D. H.

Glycine of Normal Urine. GUSTAV EMBDEN and ALFRED MARX (*Beitr. chem. Physiol. Path.*, 1908, **11**, 308—317).—Normal human urine undoubtedly yields glycine; in order to obtain it all in combination with β-naphthalenesulphonyl chloride, care must be paid to the degree of alkalinity produced. The question is discussed whether this glycine is free in the urine or in combination, and the answer is strongly in favour of the former alternative. W. D. H.

The Limits of Hippuric Acid Formation in Man. JOHANN LEWINSKI (*Arch. exp. Path. Pharm.*, 1908, **58**, 397—412).—Previous observers state the limit of hippuric acid formation in man at about 3% to 4% of the total nitrogen; in herbivora it is higher. In the present experiments, benzoic acid was given, and the number was increased to 20—30% if there is much protein in the diet, but less if the diet is protein-poor (10—16%). Even in cases of nephritis, it reached 12%. W. D. H.

The Scission of Hippuric Acid by Bacteria; the Detection of Benzoic Acid and Glycine in Urine. Y. SEO (*Arch. exp. Path. Pharm.*, 1908, **58**, 440—449).—Very contradictory results have been obtained by different observers, who have administered benzoic acid to the human subject. Some have obtained large quantities of hippuric acid in the urine, and others only small quantities. The discrepancies are due to the fact that hippuric acid readily undergoes scission in the presence of bacteria. If the urine of a normal individual is sterilised or is kept with antiseptics, but little free benzoic acid will be found. If, however, no precautions for asepsis be taken, the hippuric acid will readily undergo scission into benzoic acid and glycine; the latter substance can be isolated by means of naphthalenesulphonyl chloride.

The free benzoic acid can be estimated by direct extraction with light petroleum, and the conjugated benzoic acid by hydrolysing the urine (after separation of the free benzoic acid) with sulphuric acid, steam distilling, and extraction of the distillate with light petroleum. The bacteria which bring about the hydrolysis of hippuric acid are *Staphylococcus albus* and *S. aureus.* Various streptococci have a similar action. *B. coli, typhus* and paratyphus bacilli, and *B. pyocyaneus* are without action.

The presence of free benzoic acid in freshly-collected urine is possibly of some diagnostic value. S. B. S.

A Thermo-soluble Protein, said to be that of Bence Jones. ALBERT GASCARD and DEVALMONT (*J. Pharm. Chim.*, 1908, [vi], 27, 371—374. Compare this vol., ii, 212).—When heated by itself, the urine described was coagulated at 50°, and became almost clear between 80° and 100°. The precipitates formed by various protein reagents redissolved at 100°. The urine gave the biuret reaction, and yielded a precipitate when saturated with ammonium sulphate, but not with magnesium sulphate. On addition of an equal volume of 90% alcohol, no precipitate was formed on heating to 70°.

After acidification with acetic acid, the urine yielded hardly any precipitate on heating, and after dialysis the solubility of the albumose in acetic acid was further increased. G. B.

Pancreatic Diabetes in Selachian Fishes. V. DIAMARE (*Zentr. Physiol.*, 1908, 21, 863—869. Compare Abstr., 1907, ii, 285).—Complete extirpation of the pancreas in these fishes causes an intense glycæmia. Partial extirpation, even if three-quarters of the organ are removed, does not produce the effect, even though the injury to vessels and nerves is as great as in the complete operation. Necrosis of the stomach, duodenum, or spleen does not take place. W. D. H.

Antagonistic Action of Calcium and Magnesium. SAMUEL J. MELTZER and JOHN AUER (*Proc. Roy. Soc*, 1908, 80, *B*, 260—261; *Amer. J. Physiol.*, 1908, 21, 400—419).—A detailed account of work recorded previously (this vol., ii, 312). W. D. H.

The [Physiological] Action of Strontium compared with that of Calcium and Magnesium. SAMUEL J. MELTZER and JOHN AUER (*Amer. J. Physiol.*, 1908, 21, 449—453).—Strontium salts do not cause anæsthesia, nor do they affect sensibility and reflex action. They cause paralysis slowly, and only after very large subcutaneous doses. Strontium does not neutralise the inhibitory effect of magnesium; it causes a slight improvement of respiration, but otherwise it aggravates the inhibitory symptoms due to magnesium, especially the paralysis. Calcium is not antagonistic to the effects of strontium; if anything, it increases them. Physiologically, strontium differs radically from both calcium and magnesium.

W. D. H.

Antagonistic Action of Barium Chloride and Sodium Sulphate on the Heart Action. V. Scaffidi (*Biochem. Zeitsch.*, 1908, **9**, 489—497).—The experiments were carried out on the heart of frogs and tortoises by the method of Engelmann. Barium chloride gives rise to a lengthened systolic period and pause, with a diminution of the number of heart-beats per minute. If sodium sulphate is injected half an hour after the barium chloride, it exerts no influence; on the other hand, if the barium salt is injected half an hour after the sodium salt, the latter inhibits the action of the former. If equivalent quantities of the two salts are injected simultaneously, the antagonistic action is complete. The chemical action of the two salts on the heart muscle is discussed.

S. B. S.

Therapeutic Value of Methyl Benzoylsalicylate (Benzosalin). Mario Varanini (*Chem. Zentr.*, 1908, i, 666; from *Arch. Farm. sperim.*, 1907, **6**, 623—630).—The action of saliva on benzosalin is shown to be very slight, only a small quantity of salicylic acid being formed; the addition of pepsin hydrochloride increases the amount somewhat, whilst pancreatin readily breaks down the benzosalin, especially in presence of sodium hydroxide at 37°. Normal and excessively acid gastric juice even after long contact at 37° have no action on benzosalin, whereas it is rapidly decomposed in an alkaline gastric juice. The conclusion is drawn therefore that benzosalin is decomposed in the intestine by the pancreatic juice in alkaline solution, and not in the stomach.

J. V. E.

Physiological Effects of Colchicine. Walter E. Dixon and Walter Malden (*J. Physiol.*, 1908, **37**, 50—76).—Colchicine, like muscarine, excites the nerve-endings in plain muscle, but has no action on those in the heart or in glands. Pilocarpine, physostigmine, and colchicine act on different constituents of the nerve-ending. Colchicine, even in enormous doses, is a slow poison, especially in herbivora; the delay is due to slow absorption into the central nervous tissues, and death is caused by vaso-motor paralysis. It causes marked leucocytosis, the varieties of white corpuscles, which are increased, being different in carnivora and herbivora. There is increased activity of the bone marrow, all the elements of which may be found in the circulation after large doses. Increase of leucocytes, body temperature, and coagulation time of the blood run approximately parallel.

W. D. H.

Action of Digitalin. Kurt Huldschinsky (*Arch. exp. Path. Pharm.*, 1908, **58**, 413—433).—Digitalin produces inhibition of the frog's heart; this is mainly due to excitation of the inhibitory nervous mechanism, and partly to action on the heart muscle. W. D. H.

Action of Digitalis on the Vagus. Camill Lhoták von Lhota (*Arch. exp. Path. Pharm.*, 1908, 58, 350—365).—In severe poisoning by substances of the digitalis group, the vagus nerves lose their excitability; they are finally paralysed, and a "vagus pulse" is the result. This condition is increased by physostigmine, and lessened by *apo*morphine. It lasts thirty to fifty minutes. W. D. H.

The Degradation of 2:5-Diketopiperazines in the Organism of the Rabbit. Emil Abderhalden (*Zeitsch. physiol. Chem.*, 1908, 55, 384—389).—After administration of glycine anhydride to a rabbit, both glycine and glycylglycine could be isolated from the urine in the form of the naphthalenesulphonyl derivative. After administration of *dl*-alanine anhydride, *l*-alanine could be detected in the urine; there was also some evidence in this case that an alanylalanine was also excreted. After administration of *dl*-serine anhydride, *d*-serine could be isolated in the form of the *p*-nitrobenzoyl derivative. It appears therefore that the piperazines are first hydrolysed to the dipeptides, which, on further hydrolysis, yield amino-acids. It is not, however, quite certain that the peptides and amino-acids are not formed as secondary products by the action of the alkaline urines on the piperazines. This seems improbable, however, as optically active amino-acids were formed. S. B. S.

The Physiological Behaviour of Inosite. II. Paul Mayer (*Biochem. Zeitsch.*, 1908, 9, 533—536).—Inactive lactic acid is found in the urine of rabbits after injection of inosite. This fact is of interest, as those organs (for example, muscles) which contain inosite also contain lactic acid. S. B. S.

Behaviour of Sajodin [Calcium Iodobehenate] in the Organism. Georg Basch (*Zeitsch. physiol. Chem.*, 1908, 55, 397—406).—A small portion of this substance is excreted unchanged in the fæces; the greater part is absorbed, and retained in the body, especially in bone marrow, fatty tissue, and thyroid gland, passing later into the blood and reaching the urine as alkali iodide.

W. D. H.

The Material in the Brain which Unites with Tetanus Toxin. Kenji Takaki (*Beit. chem. Physiol. Path.*, 1908, 11, 288—303).—Hot alcohol extracts from dried brain material a substance which combines with the tetanus toxin. The material present which acts in this way is cerebron; the cerebrin acids have a weaker action. Of the cleavage products of cerebron, cerebrinic acid and its methyl ester are active in the same direction. The white matter of the brain is, however, capable of combining with more poison than the amount of cerebron in it accounts for; the grey matter is more powerful than the white, and contains less cerebron. There must be therefore other substances which are capable of combining with the tetanus toxin. W. D. H.

Influence of Certain Poisons in the Fibrillary Contraction of the Heart. Heinrich Winterberg (*Pflüger's Archiv*, 1908, 122, 361—379).—Poisons which paralyse the inhibitory mechanism of the heart also prevent the occurrence of fibrillary contractions which follow faradic stimulation. These contractions, however, occur if, as under the influence of nicotine, the conduction of the nerve fibres concerned is alone interfered with. The phenomenon is increased if the cardiac vagus is in a condition of increased excitability, as it is under the influence of physostigmine. On the same grounds, muscarine is believed to stimulate the cardiac vagus. Toxic stimulants, such as physostigmine and calcium, which produce extra systoles, can by simultaneous faradic stimulation of the vagus bring the auricles into fibrillary delirium. W. D. H.

Munchi Arrow Poison and Strophanthin. George Ralph Mines (*J. Physiol.*, 1908, **37**, 37—49).—Strophanthin is the chief toxic ingredient of the Munchi arrow poison. It is antagonistic to veratine in its action on skeletal muscle. W. D. H.

Poisonous Substances in Blood. G. Lefmann (*Beitr. chem. Physiol. Path.*, 1908, **11**, 255—273).—The intravenous injection of lipoids prepared from red corpuscles of a different species of animal produces in cats, dogs, and rabbits poisonous symptoms (fall of blood pressure, paralysis, narcosis, &c.). If, however, the lipoids are prepared from the same kind of animal, they are non-toxic, or only slightly toxic. The toxic material is soluble in anhydrous ether, but not in alcohol or chloroform. By shaking an emulsion of it in salt solution with olive oil, the lipoids are in great measure removed. They are in such an emulsion thermostable. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Nitrogen-fixing Bacteria. III. F. Löhnis and N. K. Pillai (*Centr. Bakt. Par.*, 1908, ii, **20**, 781—799).—The authors are repeating some of the work which other investigators have published on this subject, and in the present communication deal with (1) the carbon compound to be used in the culture solution; (2) the effect of manuring on the nitrogen-fixing power of soil, and (3) the variation in nitrogen-fixing power from month to month.

(1) *The Best Carbon Compound for the Culture Solution.*—Mannitol and xylose were found to be the most effective, and humus (for example, Merck's humic acid neutralised by potash) least. The substances tried and the amount of nitrogen fixed in ten days per gram of substance were as follows:

Mg. of nitrogen fixed.	
7·5 to 10	Mannitol, xylose, lactose, lævulose, inulin, galactose, maltose, arabinose, dextrin, sucrose + $CaCO_3$.
5 to 7·5	Dextrose, sucrose, sodium tartrate + $CaCO_3$, glycerol + $CaCO_3$.
2·5 to 5	Starch, sodium tartrate, sodium succinate, calcium lactate.
1 to 2·5	Sodium propionate, sodium citrate, glycerol.
Nil	Calcium butyrate, potassium oxalate, humus.

(2) *Effect of Manuring.*—Culture solutions made up with mannitol were inoculated with soil off the experimental plots which are each year manured in the same way. The amount of nitrogen fixed, No. 1 unmanured being taken as 100, and the average crop for the past three years were:

	Unmanured.			Dung.	Sodium nitrate, potassium salts, lime.	Sodium nitrate, potassium salts, lime, superphosphate.	Sodium nitrate, lime, superphosphate.
	I.	VI.	XI.	III.	VII.	VIII.	X.
Nitrogen fixed	100	104	153	114	122	206	224
Crop	100	94	85	119	139	152	147

It will be observed that on this particular soil, dung has not greatly increased the nitrogen-fixing power, but superphosphate exerts a considerable effect. The crop returns run in somewhat the same sense. The experimental error appears to be considerable.

Effect of the Time of the Year.—Samples taken from the plots in different months show varying powers of fixing nitrogen when inoculated into culture solutions; in some cases, the power increases steadily from early spring until late autumn, and in others there is a falling off during the summer, so that two maxima are observed, one in spring and the other in autumn; the authors regard the latter as the typical case. The following results may be quoted:

	March.	April.	May.	July.	October.
Samples taken in milligrams N fixed by unmanured soil (Plot VI)	1·52	2·11	2·74	4·00	7·94
Samples taken in milligrams N fixed by soil fully manured (Plot VIII)	3·19	10·8	10·93	13·08	13·8

In making these experiments, 10 grams of soil were inoculated into 100 c.c. of the culture solution. E. J. R.

Fixation of Free Atmospheric Nitrogen by Lolium Temulentum, infested with a Fungus. E. HANNIG (*Ber. deut. bot. Ges.*, 1908, **26a**, 238—248).—As found by Hiltner in 1896, the above grass is peculiar in assimilating small quantities of free nitrogen, although it has no symbiotic root organisms. It is generally, however, infested by a parasitic fungus, which lives in the seeds; other species of *Lolium*, without a fungus, do not assimilate free nitrogen.

This observation is now confirmed, and the comparison was effected, not, as before, with other species of the same genus, but with fungus-free individuals of the same species. If no combined nitrogen was given in the food, the amount of nitrogen in the plants without the fungus was the same as in the seeds, but in the plants with the fungus it was approximately double. (With a nitrogenous soil, the amount of nitrogen in the plant may be one hundred times that of the seed.) The investigation was mainly directed towards excluding the bacterial action in the roots; the seeds were sterilised (except as regards the fungus parasite, which is inside the seed-coat) by ten minutes' immersion in 1% mercuric chloride, and the plants were grown in a special apparatus in such a way that their roots remained inaccessible to bacteria. G. B.

Nitrification in Acid Soils. ALFRED D. HALL, NORMAN H. J. MILLER, and CONRAD T. GIMINGHAM (*Proc. Roy. Soc.*, 1908, 80, *B*, 196—212).—The Rothamsted grass plots which receive large quantities of ammonium salts as manure are found to be acid to litmus paper, and to contain practically no calcium carbonate, instead of 2% to 5% as in the other plots. The character of the vegetation is fundamentally affected; there is a rank herbage consisting almost entirely of three species of grass growing in coarse tufts with bare, peaty patches between. Previous investigation has shown that soils from these plots are almost free from nitrifying organisms, and this observation is now fully confirmed. In general, there was no nitrification when the soil was inoculated into culture solutions, and very little when 1 or 2 kilos. of moist soil were exposed to air under favourable conditions. Whilst it cannot be said that no nitrification takes place, there is so little that the plants cannot obtain in the form of nitrates all the nitrogen they take up from the soil, but must draw the larger portion directly from the ammonium salts supplied as manure.

An aqueous extract of the soil was found to be acid, and to contain humates, chlorides, and sulphates. Since free humic acid is not a normal product of decay in the soil, it seems probable that the acid originates from the ammonium salts; this view is supported by the fact that the amount of freely soluble acid of the soil is of the same order of magnitude as the quantity of sulphuric and hydrochloric acids contained in one year's application of ammonium salts. The authors therefore suppose that the acid splits off from the ammonium salt, and slowly acts on the calcium humate present in the soil, forming calcium chloride and sulphate, which wash away in the drainage water, and free humic acid, which remains in the soil.

Experiments were made to find if any agency existed in the soil capable of splitting up ammonium salts so as to set free the acids therein. No purely chemical or physical hypothesis was satisfactory; free acid does not arise from the interactions of ammonium salts with either the double silicates or the calcium humate in the soil, neither is there any dissociation of the salts followed by adsorption or evaporation of ammonia leaving an acid residue. The soil was, however, found to contain certain moulds, *Penicillium glaucum* and another allied to *Mucor*, capable of taking the ammonia from ammonium sulphate and leaving behind the free acid until the acidity is about $N/80$, when action ceases. The authors conclude therefore that the acidity of the soil is due to the action of these moulds.

Although the soil is acid, nitrification is not entirely checked; probably this results from the lack of uniformity of the soil. Particles of calcium carbonate still remain, each of which is a centre of nitrification. When the soils becomes uniformly acid, all nitrification must cease. E. J. R.

Bacteria as Agents in the Oxidation of Amorphous Carbon. M. C. POTTER (*Proc. Roy. Soc.*, 1908, 80, *B*, 239—259).—Lamp black, charcoal, coal, and peat can all be oxidised by a *Diplococcus* obtained from garden soil, and no doubt by other organisms as well. The action is only small, but it was quite clearly established (1) by passing a stream of air, freed from all traces of carbon dioxide, over the material and determining the presence of carbon dioxide in the issuing gas by absorption with baryta and titration with oxalic and hydrochloric acids ; (2) by determining the rise of temperature due to oxidation by means of a thermopile and galvanometer, and (3) by detecting, in the case of charcoal, the presence of calcium carbonate in the flasks inoculated with the bacteria. Oxidation only takes place under conditions favourable to bacterial activity ; thus the rate increases with the temperature to 40°, but at 100° there is no oxidation at all. Similarly, oxidation ceases when the amount of moisture present is insufficient for bacteria. It follows that micro-organisms are entirely responsible, and the author refers to various consequences of such an action, suggesting, among other things, that the heat generated by the bacterial activity may be an important factor in determining the spontaneous combustion of coal, or firing a mixture of explosive gases in contact with it. E. J. R.

Ten Years' Experiments on Denitrification in Arable Soil. Gaspare Ampola (*Ann. R. Staz. chim. agrar. sper. Rome*, 1907, [ii], 1, 29—73).—Application of fresh farmyard manure in conjunction with sodium nitrate and minerals gives lower yields than nitrates and minerals alone ; the reduction in yield increases with the amount of straw in the manure. Humification of the manure diminishes the reducing action of the denitrifying organisms.

Calcium nitrate is less subject to denitrification than the sodium salt.

In practice, nitrates, when used in conjunction with farmyard manure, should be applied after the straw has had time to decompose sufficiently ; no loss by denitrification is then to be feared.

N. H. J. M.

Butyric Acid Fermentation. Eduard Buchner and Jakob Meisenheimer (*Ber.*, 1908, **41**, 1410—1419).—In this preliminary note on the production of compounds containing 4 atoms of carbon by the fermentation of substances containing three or six, the results of two experiments on dextrose and glycerol, and a detailed account of the analysis of the products of fermentation, are quoted.

The solution of dextrose or of glycerol in the presence of nutritive inorganic salts and calcium carbonate was fermented for many weeks by *Bacillus butylicus*. The same products were obtained in each experiment: ethyl and butyl alcohols, formic, acetic, butyric, and lactic acids, carbon dioxide, and hydrogen, but, whilst glycerol yielded large amounts of the alcohols and only small quantities of acetic and butyric acids, the converse was found to be the case with dextrose.

The authors suggest the following course of the fermentation. In both cases, lactic acid is an intermediate product (Abstr., 1906, ii, 790) which yields formic acid and acetaldehyde (compare Schade, Abstr., 1907, ii, 857 ; this vol., i, 136) ; the latter polymerises to aldol, which either undergoes intramolecular change to butyric acid, just as glyceraldehyde yields lactic acid, or else loses water, giving crotonaldehyde, which by reduction yields butyl alcohol or the corresponding aldehyde. C. S.

Sarcinæ causing Disease in Beer. Oldřich Miškovský (*Chem. Zentr.*, 1908, i, 665; from *Zeitsch. ges. Brauwesen*, 1908, **31**, 3—6, 16—19, 27—29).—In the presence of Witte's peptone, the *Pediococci A*, *B*, *F* will grow in solutions of dextrose and maltose from which the usual inorganic salts are removed. Somatose and yeast-nucleic acid are not developed when only amino-acids are the source of nitrogen. The addition of dipotassium phosphate causes an increase of *Sarcinæ* in beer wort; monopotassium phosphate has a retarding effect. *Sarcinæ* development is detected by the smell, increase of acidity, and by a cloudy appearance, the last being dependent, not only on the organism employed, but also on the chemical composition of the culture solution. *Pediococcus F* in malt extract forms inactive lactic acid, also traces of formic acid and alcohol, but no acetone. J. V. E.

Chemical Monograph of the Cladoniaceæ. Wilhelm Zopf (*Ber. deut. bot. Ges.*, 1908, **26**, 51—113. Compare Abstr., 1907, i, 218).—The author has examined more than fifty species and varieties of lichens, chiefly as regards acids soluble in acetone. In some respects, the chemical relationship corresponds with that deduced from morphological characters, but in others there is marked disagreement. The colouring matter, to which the red colour of the apothecia of many species is due, was obtained crystalline and named *rhodocladonic acid.* It has the composition $C_{14}H_{10}O_7$ or $C_{12}H_8O_6$, dissolves slightly in hot acetic acid and chloroform with a yellow colour, and decomposes between 200° and 300°. It is soluble in sodium and potassium hydroxides and in sodium hydrogen carbonate with a reddish-brown colour, and reduces cold alkaline permanganate solution. A relationship to alizarin is suggested. G. B.

Composition of the Milk and Ferments of the Fruit of Cocos nucifera. E. de Kruyff (*Chem. Zentr.*, 1908, i, 746; from *Bull. Dépt. Agric. Indes. néerland*, **4**).—The liquid from cocoanut contains gases composed of 98% CO_2, 0·2% oxygen, and 0·3% nitrogen, besides sucrose, diastase, oxydase, and catalase. Lipase, a proteolytic diastase, amylase, catalase, and peroxydase are also found in the substance of the fruit. J. V. E.

Examination of Grindelia. II. Frederick B. Power and Frank Tutin (*Proc. Amer. Pharm. Assoc.*, 1907, **55**, 337—344. Compare Abstr., 1906, ii, 885).—The portion of *Grindelia* resin soluble in light petroleum consists of a complex mixture of liquid acids and their glycerides. The acids are optically active and unsaturated, and some appear to contain benzene nuclei, and some are hydroxy-acids. Cerotic and palmitic acids are present in small amounts.

The ethereal extract of the resin contains very small amounts of a crystalline *alcohol*, $C_{17}H_{28}O_3$ or $C_{23}H_{38}O_4$, m. p. 256—257°, yielding an acetyl derivative, m. p. 161°, and a yellow, crystalline *phenolic substance*, $C_{14}H_{12}O_5$, m. p. 227—228°, and yielding an acetyl derivative, m. p. 154°. G. B.

Constituents of the Root-bark of Morinda citrifolia. OTTO A. OESTERLE and ED. TISZA (*Arch. Pharm.*, 1908, **246**, 150—164).—Perkin and Hummel have shown that this material contains morindin (Trans., 1894, **65**, 851), and the present paper confirms this observation and records the occurrence in the plant of two new constituents and several substances previously found by Perkin and Hummel (*loc. cit.*) in the related plant *M. umbellata*.

The portion of the root-bark soluble in alcohol, after the removal of morindin, was separated into (*a*) matter insoluble in water, and (*b*) matter soluble in water. The part (*a*) was subdivided into constituents (*c*) soluble in and (*d*) insoluble in chloroform.

The constituents included in (*b*) were: (1) a dihydroxymethylanthraquinone, which was named *soranjidiol*, $C_{15}H_{10}O_4$, m. p. 276°, and crystallises in dark reddish-brown needles, dissolves readily in alcohol or ether, slightly in water, and yields a *diacetyl* derivative, m. p. 230°, which crystallises in lemon-yellow needles. (2) An amorphous resin, dissolving in alkalis with a red coloration. (3) A substance, $C_{16}H_{10}O_5$, identical with one found by Perkin and Hummel in *M. umbellata*, and (4) an indefinite product, *morindanigrin*, resembling those obtained by Tschirch and his collaborators from senna, &c. (Abstr., 1900, i, 681).

The constituents present in (*c*) were: (1) a wax, $C_{18}H_{28}O$, and (2) a monomethyl ether of a trihydroxyanthraquinone, both identical with substances found by Perkin and Hummel in *M. umbellata*.

The portion (*d*) contained, in addition to indefinite resinous matters, a second dihydroxymethylanthraquinone, which was named *morindadiol*, $C_{15}H_{10}O_4$, m. p. 244°. This crystallises in yellow needles, sublimes in slender, red needles, is readily soluble in alcohol or acetic acid, less so in ethyl acetate or toluene, and insoluble in ether or light petroleum; the *diacetyl* derivative, m. p. 229°, crystallises in lemon-yellow needles.

On extraction of the bark with dilute sulphuric acid, morindin and its decomposition product, morindone, were obtained together with much chlororubin, possibly produced by the action of the acid on the morindanigrin referred to above. No morindone was obtained by extraction of the bark with ether, so that this substance does not occur preformed. T. A. H.

The Constituents of Simaruba Bark. CHARLES GILLING (*Pharm. J.*, 1908, [iv], **26**, 510—513).—The bark of *Simaruba amara* contains 0·05—0·1% of a *bitter substance* $C_{22}H_{30}O_9$, forming rosettes of small, white needles from dilute methyl alcohol, m. p. 229—230° (decomp.); $[\alpha]_D$ in chloroform solution 67·6°, in alcohol solution 58°. The bark further contains a fixed oil, a resin, and a crystalline non-bitter substance; the presence of a fluorescent substance was indicated. G. B.

Natural Factors in the Dissolution of Tricalcium Phosphate in Soil. RENATO PEROTTI (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 448—451).—When nitrogen is administered in the form of various compounds to cultures of soil bacteria in a nutrient medium containing tricalcium phosphate, a considerable amount of phosphoric oxide goes into solution when the nitrogen compound added is physiologically acid, but only a small amount is dissolved when the compound is physiologically alkaline. The compounds employed were ammonium tartrate, potassium nitrate, ammonium sulphate, urea, and asparagine; the effect of the ammonium sulphate is by far the greatest, both in intensity and in duration (compare Prianischnikoff, Abstr., 1906, ii, 796). T. H. P.

Influence of Manures on the Composition of Wheat. Harry Snyder (*J. Amer. Chem. Soc.*, 1908, **30**, 604—608).—Analyses were made of sixty samples of wheat grown at twelve different places under various manurial conditions. Application of manures resulted in larger, better filled and better coloured grain, especially in cases in which the yield was increased. In eight experiments, phosphates increased the weight per bushel, and in five experiments potash produced a similar result. Nitrogen sometimes increased and sometimes diminished the weight per bushel, but when applied alone had less beneficial effect than minerals alone. Unfavourable seasons affect crops grown on soils of low fertility more than on soils of high fertility.

As regards the composition of the grain, it was found that nitrogenous and mineral manures sometimes improved the quality of the wheat, although the increase in protein was only slight. Nitrogen alone may increase the amount of protein, and at the same time injure the quality of the wheat.

No constant relationship seems to exist between the percentage of protein in the grain and flour and the bread-making value; in many cases, the increase in nitrogen was coincident with a negative value. On the whole, however, the experiments show that both the yield of wheat and the bread-making value can be increased by manuring. In thirty out of forty-one experiments, the manures which gave the greatest yields also produced wheats of the highest value for bread making. N. H. J. M.

Phosphoric Acid in Barley. Wilhelm Windisch (*Chem. Zentr.*, 1908, i, 865; from *Jahrb. Vers. Lehr. Braueri*, 1907, **10**, 56—58).—This acid is present in barley as phytin, the calcium magnesium salt of anhydro-oxymethylenediphosphoric acid, which gives phosphoric acid and inosite when acted on by strong acids or enzymes. J. V. E.

Manganese Compounds as Fertilisers for Maize. Walter F. Sutherst (*Transvaal Agric. J.*, 1908, **6**, 437).—The experiments were made in pots 3 feet high with an area of about 1 square yard. Manganese was added to the soil in the form of chloride (2 grams), sulphate (2 grams), and pyrolusite (5 grams per pot). Photographs of the plants show that pyrolusite gave much the best results. With manganous chloride, a considerable improvement both in size and quality was obtained as compared with the unmanured plants, whilst manganous sulphate had less effect. N. H. J. M.

Action of Manganese on Potatoes and Sugar Beet. ACH. GRÉGOIRE, J. HENDRICK, and EM. CARPIAUX (*Bul. Inst. Chim. Bact. Gembloux*, 1908, No. 75, 66—72. Compare Birner and Lucanus, *Landw. Versuchs-stat.*, 8, 128; Wagner, *ibid.*, 13, 69, 278; Bertrand, Abstr., 1897, ii, 493; 1898, i, 53 and ii, 128; 1906, ii, 121; Giglioli, *ibid.*, 1901, ii, 527; Loew, Honda, and Fukutome, *ibid.*, 1904, ii, 766; Passerini, *ibid.*, 1906, ii, 117; Voelcker, *ibid.*, 1906, ii, 388; van Dam, *ibid.*, 1907, ii, 649).—Results of field experiments with potatoes showed that an application of manganous sulphate (50 kilos. per hectare) resulted in an average increase of 7%. A smaller amount (10 kilos.) was without effect. Similar experiments with sugar beet showed that manganese sulphate diminished the yield of roots, whilst the percentage of sugar in the roots was increased; the yield of sugar was the same in both cases. N. H. J. M.

Analytical Chemistry.

Differential Method of Blood-Gas Analysis. JOSEPH BARCROFT (*J. Physiol.*, 1908, 37, 12—24).—A full account with mathematical data of the method previously published (see this vol., ii, 319).

W. D. H.

New Capillary and Capillary-Analytical Investigations. FRIEDRICH GOPPELSROEDER (*Chem. Zentr.*, 1908, 1, 760—761; from *Verh. Naturf.-Ges. Basel*, 1907, 19, 1—81).—A large number of experiments with pure filter paper as capillary agent. The velocity of the capillary action per minute and its final extent were measured; this depends largely on atmospheric pressure. The process is recommended for the detection of minute traces of such substances as strychnine hydrochloride, morphine hydrochloride, and stovaine hydrochloride; a reaction may then be obtained on the paper. The capillary action seems to depend on the molecular weight, but there are exceptions to this rule. The test may be useful in milk analysis; the components are separated from each other, and may be identified. The mineral constituents are found at the bottom of the paper. Watered milk rises highest. L. DE K.

Electrolytic Analysis. FRITZ FOERSTER (*Zeitsch. Elektrochem.*, 1908, 14, 208—211).—ALEXANDER CLASSEN (*ibid.*, 239).—A continuation of the polemic on this subject (this vol., ii, 226, 322, 432).

T. E.

Use of the Filtering Crucible in Electrolytic Analysis. FRANK A. GOOCH and F. B. BEYER (*Amer. J. Sci.*, 1908, [iv], 25, 249—255; *Zeitsch. anorg. Chem.*, 1908, 58, 65—72).—A device for handling loosely-adhering metallic deposits, consisting of a modified Gooch perforated platinum or porcelain crucible serving as electrode. For details, the illustrations in the original article should be consulted. Four different methods are given. L. de K.

Estimation of Halogen Elements in Organic Chloro-bromo-compounds. Henri Baubigny (*Compt. rend.*, 1908, **146**, 931—933.* Compare Abstr., 1903, ii, 510; 1904, ii, 203).—In order to estimate the chlorine and bromine in organic compounds, the compound is oxidised with a chromic acid mixture in the presence of silver sulphate (Abstr., 1899, ii, 328), and the liberated chlorine and bromine absorbed in an alkaline solution of alkali sulphite; this solution is made up to 500 c.c. and then divided into two equal parts, and the total halogens estimated in one part by the usual method. The other part is neutralised and concentrated to 20 to 25 c.c., the excess of sulphite destroyed by potassium permanganate, the bromine eliminated by the method described previously (Baubigny and Rivals, Abstr., 1897, ii, 385), and the chlorine in the residue determined in the usual way. M. A. W.

Thiocyanoselenious Acid and the Estimation of Selenium. W. N. Iwanoff (*Chem. Zeit.*, 1908, **32**, 468).—A solution containing 0·1—0·4 gram of selenium in 600 c.c. is mixed with 25 c.c. of ammonium thiocyanate (1 : 5), and then with 150 c.c. of 25% hydrochloric acid. The liquid is heated in a water-bath for twelve hours, and then left overnight. The thiocyanoselenious acid formed at first is decomposed with separation of selenium, which is then collected on a weighed filter, dried at 105°, and weighed. It contains, however, some admixed sulphur, which must be estimated by treatment with nitrohydrochloric acid, precipitation with barium chloride, &c., and then allowed for.

Thiocyanoselenious acid, $(HCNS)_2H_2SO_3$, forms a bulky, crystalline mass of lustrous, transparent, white, quadrangular leaflets, gradually turning yellow, and rapidly decomposed by hot water. L. de K.

Estimation of Nitrogen. H. Droop Richmond (*Analyst*, 1908, **33**, 179—183).—*The Nitrogen Factor for Casein.*—The experiments recorded give an average value of 15·65% of nitrogen in casein, as estimated by Kjeldahl's method; this corresponds with a factor of 6·39. Nitrogen is not evolved as gas in the Kjeldahl method, and high results obtained by Dumas' method were found to be due to unburnt carbon monoxide.

Triazo-nitrogen.—A process is given for the estimation of nitrogen in the series of compounds containing the triazo-group described by Forster and Fierz (Trans., 1905, **87**, 826; 1907, **91**, 855, 1350, 1942; 1908, **93**, 72). The substance was washed into a nitrometer with successive small quantities of alcohol, 2 drops of 40% formaldehyde solution were added, and then the concentrated sulphuric acid. After reading off the volume of gas, the sulphuric acid was transferred to a flask, 2 grams of zinc dust were added, and an estimation of the nitrogen was made by Kjeldahl's method. The ratio of the nitrogen found as ammonia to the total nitrogen varied from 1 : 1·83 to 1 : 2·02. W. P. S.

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* and *Bull. Soc. chim.*, 1908, [iv], **3**, 630—633.

Method for the Estimation of Ammonia in Urine. HANS MALFATTI (*Zeitsch. anal. Chem.*, 1908, **47**, 273—278).—Ten c.c. of the urine under examination are diluted with 50 c.c. of water, and the acidity is neutralised by the addition of $N/10$ sodium hydroxide solution, using phenolphthalein as indicator (a considerable quantity of the latter must be added). Three c.c. of neutral 40% formaldehyde solution are now added, and the solution is again titrated. The quantity of alkali required for the second titration corresponds with the ammonia present, as it is the amount used to neutralise the acid liberated from the ammonium salts by the combination of the ammonia with the formaldehyde. A further quantity of formaldehyde may be added to the neutralised solution; if the first quantity of formaldehyde was insufficient to combine with all the ammonia, the solution becomes acid, and the titration must be continued. If amino-acids are also present in the urine, they are estimated along with the ammonia; an estimation of the ammonia by Schloesing's method will show whether they are present or not. W. P. S.

Estimation of Phosphorus in Ash Analysis. SHERMAN LEAVITT and J. ARTHUR LECLERC (*J. Amer. Chem. Soc.*, 1908, **30**, 617—618).—The authors now state that the loss in phosphorus (this vol., ii, 428) is not due to volatilisation, but to its conversion into a form in which it is no longer precipitated by molybdate solution.

This may be remedied by heating the ash with sulphuric and nitric acids. L. DE K.

A New Method of Estimating Phosphorus in Organic Compounds. ISIDORE BAY (*Compt. rend*, 1908, **146**, 814—815).—The method described is analogous to that proposed for sulphur (this vol., ii, 319). The substance is burnt with magnesia and sodium carbonate in a "bayonet" tube, the product dissolved in dilute acetic acid, and the phosphate titrated against a solution containing 40 grams of uranium nitrate per litre, potassium ferrocyanide being used as an indicator. The results agree well with those obtained by Carius' method. E. H.

Titration of Phosphoric Acid in Superphosphates. S. KOHN (*Chem. Zeit.*, 1908, **32**, 475—476).—Twenty grams of the superphosphate are extracted with a litre of water, and 50 c.c. of the filtrate are diluted to 300 c.c. and titrated with $N/10$ alkali hydroxide (free from carbonate), with methyl-orange as indicator; the result is calculated to free phosphoric acid. A considerable excess of neutral calcium chloride is added, also a few drops of phenolphthalein, and the titration is continued. If the total number of c.c. used = m, whilst n c.c. were necessary to convert the free phosphoric acid into the primary salt, then the total amount of phosphoric acid is found from the difference $m - n$; 1 mol. of phosphoric oxide = 4 mols. of sodium hydroxide. L. DE K.

Hæmatoxylin as an Indicator in the Titration of Phosphoric Acid. ALBERT B. LYONS (*Pharm. Rev.*, 1908, **26**, 97—101).—Phosphoric acid may be titrated with great accuracy with standard alkali, using hæmatoxylin as indicator, although this does not appear to be a good general indicator. The conditions for a successful titration are that the first change of colour (from yellow to pink) should be taken as the end reaction, and that the alkali should be checked with phosphoric acid of approximately the same strength as the sample taken for analysis. Chlorides interfere somewhat with the test. L. DE K.

The Leo Process for the Estimation of the Acidity of the Monometallic Phosphates in Gastric Juice. MICHELE BARBERIO (*Chem. Zentr.*, 1908, i, 986; from *Deutsch. med. Woch.*, 1908, **34**, 104—105).—Leo's process, consisting in neutralising any free hydrochloric acid in the gastric juice by means of calcium carbonate previous to titration of the acid phosphate, has been found to give uncertain results. L. DE K.

Detection of Arsenic by means of Mercuric Chloride Solution. R. LOCHMANN (*Chem. Zentr.*, 1908, i, 485; from *Zeitsch. Österr. Apoth. Ver.*, 1907, **45**, 744—745).—The apparatus consists of a small flask fitted with a perforated cork through which passes a delivery tube bent twice at right angles; the end which dips into the reagent is drawn out to a point. A few pieces of granulated zinc and 50 c.c. of water are introduced into the flask, also a sufficiency of hydrochloric acid. The gas evolved is passed through a test-tube containing a 5% solution of mercuric chloride, but in case of sulphides a small wash-bottle containing lead acetate is interposed. When satisfied that the zinc and acid are arsenic-free, the solution supposed to contain the arsenic is introduced, and, if present, a flocculent, pale yellow mercurial precipitate will form and, after some time, crystals of arsenious acid become visible. Antimony gives a white turbidity; in this case, some hydrochloric acid should be added to the mercuric chloride solution, but no separation of arsenic crystals then takes place. L. DE K.

Detection of Arsenic in Sulphur. J. BRAND (*Chem. Zentr.*, 1908, **1**, 762—763; from *Zeitsch. ges. Brauwesen.*, 1908, **31**, 33—34).—Five grams of the finely-powdered sample are digested for fifteen minutes in 25 c.c. of dilute ammonia (1 : 1), the filtrate is evaporated to dryness, and the residue oxidised with a few drops of nitric acid. After evaporation of the acid, the residue is dissolved in 8—10 c.c. of dilute sulphuric acid, a little pure zinc is introduced, and, after closing the top of the tube with a piece of cottonwool, the hydrogen evolved is tested for arsenic hydride as usual by means of a disk of filter paper moistened with a drop of strong silver nitrate. L. DE K.

Detection of Arsenic [in Fabrics]. ALFRED BEHRE (*Pharm. Zentr.-h.*, 1908, **49**, 355—357).—If any substance is found to be free from arsenic by the Gutzeit test (yellow spot on filter paper impregnated with silver nitrate), it may be passed as satisfactory, but should the test be positive it is still necessary to apply the Marsh test as well.

In any case, it is advisable to get rid of any sulphides in the colouring matters by oxidation with nitric acid and evaporation with sulphuric acid, or by means of hydrochloric acid and potassium chlorate; the Gutzeit test is then more trustworthy. L. DE K.

Parr's Method of Estimating the Heat of Combustion of Coal. SAMUEL W. PARR (*Zeitsch. angew. Chem.*, 1908, **21**, 970—976. Compare *ibid.*, 1906, **19**, 1796; Abstr., 1900, ii, 710; 1902, ii, 432). —Attention is drawn to the fact that unless anhydrous sodium peroxide is used, it is necessary to estimate the amount of moisture absorbed by this substance before it is used for combustion purposes; experimental data are given which show the importance of this point. Complete combustion is best aided by the addition of potassium chlorate to the sodium peroxide, but it is found that two parts of potassium persulphate and one part of ammonium persulphate form an excellent mixture for this purpose. The heat of combustion of carbon and also of hydrogen (to liquid water) is shown to be in each case 73% of the total heat of the reaction with sodium peroxide. The following table of correction factors is given, together with examples of their use with various varieties of coal:

Sulphur	0·006°	for 1% in 0·5 gram substance.
Ash	0·001	,, 1% ,, 0·5 ,, ,,
Water of combination......	0·0033	,, 1% ,, 0·5 ,, ,,
Potassium chlorate	0·040	,, 0·5 gram.
Fuse	0·008	,, 10 mg. burnt.

J. V. E.

Estimation of Carbon Monoxide, Especially in Tobacco Smoke. H. MARCELET (*Bull. Soc. chim.*, 1908, [iv], **3**, 556—558).—Estimations of the amount of carbon monoxide in tobacco smoke, using cuprous chloride in hydrochloric acid as an absorbent, showed that one gram of tobacco, smoked in cigarette form, yields from 20 to 80 c.c. of this gas, whilst the same amount, smoked in a pipe, yields from 53 to 100 c.c. Some difficulty was experienced in confirming these results when the carbon monoxide was estimated by means of iodic acid, but eventually by diluting the smoke with air, so that the mixture contained 0·8 to 1·0 per cent. of carbon monoxide and using a modified form of Levy and Pecoul's apparatus, similar results were obtained. T. A. H.

Separation of Silica and Alumina in Iron Ores. T. GEORGE TIMBY (*J. Amer. Chem. Soc.*, 1908, **30**, 614—615).—A criticism of the process devised by Dean (Abstr., 1907, ii, 818). The ignition method with or without addition of sulphur is not universally applicable to the accurate estimation of silica and alumina in iron ores. L. DE K.

Determination of Alkalinity by Electrochemical Means. A. E. Lange (*Zeitsch. Ver. deut. Zuckerind.*, 1908, 453—468).—An exhaustive investigation, illustrated with a curve and tables; the following conclusions have been arrived at. The point of neutrality obtained by determining the conductivities or by employment of "concentration chains" does not coincide with that obtained by the usual indicators; it agrees best with that given by phenolphthalein. The point of neutrality of pure sucrose to which acid or alkali has been purposely added may be sharply determined by either of the two electric methods, but with raw sugars or molasses the two methods utterly fail. For the determination of alkalinity in raw sugars, phenolphthalein is to be recommended as a suitable indicator. L. de K.

Volumetric Estimation of Alkali Hydroxides Containing Carbonates by Winkler's Method. Sören P. L. Sörensen and A. C. Andersen (*Zeitsch. anal. Chem.*, 1908, **47**, 279—294).—It is shown that trustworthy results can only be obtained by this method if the precipitation with barium chloride is carried out whilst the solution is hot and when the solution contains only normal carbonate, or, at most, a minute quantity of free alkali. If the solution contains the latter or a hydrogen carbonate, a sufficient quantity of either hydrochloric acid or sodium hydroxide, as the case may be, must be added before the solution is warmed, in order to remove the free alkali or alkali hydrogen carbonate. The requisite amount to be added is ascertained by a previous titration. If solutions of pure normal alkali carbonates are precipitated whilst hot with barium chloride, only normal barium carbonate is thrown down; if the precipitation takes place in the cold, more or less barium hydrogen carbonate is formed, and the supernatant solution becomes alkaline. The statement by Le Blanc (Abstr., 1907, ii, 505), that the solution becomes acid in these circumstances, is probably due to his having worked with alkali carbonate containing hydrogen carbonate. If the solution contains alkali hydroxide, the precipitate of barium carbonate will contain more or less basic carbonate, according to the quantity of alkali hydroxide present. W. P. S.

Estimation of Potassium by the Platinichloride Method. Henri J. F. de Vries (*Chem. Weekblad*, 1908, **5**, 261—269. Compare this vol., ii, 430).—Experiments showing the extent to which potassium may be retained in the barium sulphate formed on converting potassium sulphate into chloride by means of barium chloride. Addition of hydrochloric acid does not diminish the extent of the occlusion.

Hence, in using Stohmann's process, the loss will be such that, instead of, say, 27% of K_2O, at most 26·6% will be found. It must be remarked that the loss would be even greater were it not that in practice the volume of the precipitate formed is neglected. This volume may be approximately determined by noticing the amount of barium chloride used for precipitation, and dividing the calculated weight of the sulphate by 4·2. L. de K.

Estimation of Potassium in Soils. Léon Ronnet (*Ann. Chim. Anal.*, 1908, **13**, 141—143).—Twenty-five grams of the soil are heated in a flat porcelain dish with 25 c.c. of nitric acid (more if carbonates are present) for three hours. Some water and a few drops of barium nitrate solution are added, the solution is evaporated to dryness, and the residue heated to incipient redness. Ferric and aluminium nitrates are quite decomposed, and those of calcium and magnesium but partly.

The residue is treated with water and 10—20 grams of oxalic acid, and the whole is again evaporated to dryness. The residue is heated to redness until all the oxalic acid has disappeared; by this treatment, the calcium, magnesium, and barium are also rendered insoluble. The mass is powdered and introduced into a flask, and treated with hot water (250 c.c.); when cold, water is added up to the mark, and also an extra 10 c.c. to compensate for the volume occupied by the insoluble matter. Two hundred c.c. of the filtrate are then evaporated to dryness, and the residue ignited once more with a few grams of oxalic acid. The mass is then dissolved in a little hot water, and, after acidifying the filtrate with hydrochloric or nitric acid, the potassium is estimated either by the platinum or the perchlorate process.

L. DE K.

Practical Modification of the Method for Determining the Hardness of Water. Value of the Process. FERNAND TELLE (*J. Pharm. Chim.*, 1908, [vi], **27**, 380—389).—Clark's process, as modified by Boutron and Boudet, is placed on a decimal basis by adopting as standard a solution containing 0·344 gram of crystallised calcium sulphate per litre; 50 c.c. of this solution, corresponding therefore with 0·01 gram of calcium carbonate, are titrated with soap solution, slightly alkaline to phenolphthalein, and contained in an ordinary 50 c.c. burette. One degree of hardness, on this basis, is exactly equivalent to 0·01 gram of calcium carbonate per litre, and corresponds therefore pretty closely with a degree in Boutron and Boudet's modification (0·0103 gram).

The amounts of calcium carbonate and sulphate found by the soap method, in general agree closely with the results of direct analysis.

G. B.

Detection of Barium in Strontium Salts. H. CARON and D. RAQUET (*Bull. Soc. chim.*, 1908, [iv], **3**, 483—493).—A detailed study of the sensibility of the various tests for barium alone, and in presence of strontium or calcium salts, has been made. The following are the limits of sensibility of the reagents investigated. In each case, the first fraction expresses the minimum ratio of barium to water in a solution which will give a precipitate with the reagent; the second, the minimum ratio of barium to strontium, and the third (where given) the minimum ratio of barium to calcium which can be detected by means of the reagent. Hydrofluosilicic acid, 1/2500 and 1/15; hydrofluosilicic acid, in presence of alcohol, 1/20,000, 1/75, and 1/60; strontium sulphate, 1/30,000 and 1/50; potassum dichromate, 1/100,000, 1/150, and 1/150 (approx.); strontium chromate, 1/250,000 and 1/1000; potassium chromate (3%), 1/2,500,000, 1/15,000, and 1/1,000,000. Smaller quantities of barium can be detected by most of these reagents by allowing the mixture to remain for a time; the second figures given above are for 10% solutions of strontium salt in contact with the reagent during a few minutes.

Hydrofluosilicic acid is apt under certain conditions to deposit gelatinous silica, which may be mistaken for barium silicofluoride. Many strontium salts contain strontium sulphate, which may be precipitated when the solutions are boiled, particularly in presence of acids. The impression that the addition of acetic acid to chromates, and of sodium diacetate to dichromates, make these reagents more delicate as tests for barium is, in the author's experience, erroneous. Ammonium vanadate and potassium iodate have also been suggested as reagents for detecting barium in presence of strontium, but they are of little value for this purpose in presence of a large excess of strontium. Full details are given in the original as to the best methods of applying these various reagents as tests for barium.

T. A. H.

Electrolytic Depositions on Inclined Electrodes. R. Goldschmidt (*Bull. Soc. chim. Belg.*, 1908, **22**, 138—145).—It is shown that trustworthy results may be obtained in the electrolytic deposition of zinc if, instead of a rotating electrode, a fixed electrode be used and, at the same time, a movement is given to the solution. The author employs a strip of zinc 40 cm. long and 5 cm. wide as the anode; this is placed in a narrow metal trough, which serves as the cathode, the two being fixed at a distance of about 5 mm. apart by means of glass rods placed at the edges of the anode. The whole is inclined, and the solution is allowed to flow down the trough and over the anode, and then into a collecting vessel. From this, the solution is pumped up to a vessel placed above the electrodes, and is again allowed to flow over the latter, and so on. The pump consists of a rubber tube laid in a wooden trough, and the solution is caused to pass up the tube by means of two rollers, which pass upwards over the tube, compressing it so that the solution is forced upwards. The rollers are driven by an electric motor. The electrolyte employed consisted of hydrofluosilicic acid which had been neutralised with zinc oxide or carbonate, and the best results as regards hardness and adherence of the deposit were obtained when the electrolyte contained fine sand in suspension.

W. P. S.

Estimation of Lead in Ores. Albert H. Low (*J. Amer. Chem. Soc.*, 1908, **30**, 587—589).—The impure lead sulphate obtained in due course is dissolved in a boiling solution of acid sodium acetate (made by adding 40 c.c. of glacial acetic acid to 500 c.c. of a cold saturated solution of sodium acetate diluted with 500 c.c. of water). The lead is now precipitated by potassium dichromate, and the lead chromate is next treated with a boiling solution of oxalic acid (1 part of cold saturated solution to 3 parts of water). A little alcohol is also added to assist in reducing the chromate. The lead oxalate so obtained is washed and then treated with hot dilute sulphuric acid, when the

oxalic acid liberated, which represents the lead, is titrated as usual with standard permanganate, checked by lead as described.
L. DE K.

Comparison of Two Tests of Red Lead. EUGENE E. DUNLAP (*J. Amer. Chem. Soc.*, 1908, **30**, 611—613).—Two tests are in common use for the evaluation of red lead. One consists in treating the sample with dilute nitric acid and weighing the residual peroxide, or this may be determined volumetrically. The author cannot recommend this method, but has obtained good results with the lead acetate process. The excess of lead oxide in a sample of red lead may be determined accurately by boiling with solution of lead acetate and re-weighing the undissolved matter. L. DE K.

Rapid Analysis of Copper-plating Baths. ERNESTO PANNAIN (*Gazzetta*, 1908, **38**, i, 352—355).—The following method for estimating the copper sulphate and the free sulphuric acid contained in copper-plating baths is rapid and gives good results. The liquid is first diluted to ten times its volume, and 25 c.c. then treated with an excess of powdered potassium iodide, the iodine set free being estimated by titration with *N*/10 sodium thiosulphate; the amount of copper sulphate is calculated by means of the equation: $2CuSO_4 + 4KI = Cu_2I_2 + 2I + 2K_2SO_4$. The free acid is estimated in the same solution by adding potassium iodate and titrating the liberated iodine with sodium thiosulphate. T. H. P.

Analysis of White Metal and Similar Alloys. E. SCHÜRMANN and WILHELM SCHARFENBERG (*Chem. Zentr.*, 1908, i, 986; from *Mitt. K. Materialprüfgs.-Amt.*, **25**, 270—274).—A method based on Clarke's oxalic acid process. One gram of the alloy is dissolved in 10 c.c. of hydrochloric acid containing bromine, and, after removing the latter by a current of carbon dioxide, 3—4 grams of tartaric acid are added and then a slight excess of ammonia. After removing any copper and lead by Finkener's method, the liquid is acidified with sulphuric acid and heated to 60°, and the tin, antimony, and arsenic are precipitated with hydrogen sulphide. The precipitate is redissolved in bromohydrochloric acid and then neutralised with ammonia, and at once mixed with 5 grams of oxalic acid. The solution is now diluted to 400 c.c., heated to boiling, and a current of hydrogen sulphide is passed for one hour. The precipitate containing arsenic and antimony is at once collected, the filtrate is neutralised with ammonia, again acidified slightly with acetic acid, and once more treated with hydrogen sulphide for three hours at the boiling temperature. The tin sulphide is collected, washed with water containing ammonium sulphate, and finally converted into oxide by means of nitric acid. It is as well to redissolve the antimony precipitate in hydrochloric acid and bromine, and to precipitate once more with hydrogen sulphide. The precipitate is then dissolved in sodium sulphide, and the antimony precipitated electrolytically; any arsenic remains in solution.

Pig lead is dissolved in nitric and tartaric acids, and most of the lead precipitated with sulphuric acid. L. DE K.

A System of Qualitative Analysis for the Common Elements. III. Analysis of the Aluminium and Iron Groups, including Glucinum, Uranium, Vanadium, Titanium, Zirconium, and Thallium. ARTHUR A. NOYES, WILLIAM C. BRAY, and ELLWOOD B. SPEAR (*J. Amer. Chem. Soc.*, 1908, **30**, 481—565).—After removing the metals of the hydrogen sulphide group, the solution is mixed with ammonia and ammonium sulphide, which precipitates the metals of the aluminium and iron group, including also glucinum, uranium, vanadium, titanium, zirconium, and thallium. The usual separation of nickel and cobalt by means of dilute hydrochloric acid has been abandoned, but the precipitate is dissolved in hydrochloric acid with the aid of nitric acid. The solution is then boiled with excess of sodium hydroxide and sodium peroxide, which causes the following metals to pass into solution as sodium salts: aluminium, glucinum, zinc, chromium, uranium, and vanadium. For further particulars, the tables in the original article should be consulted. L. DE K.

Estimation of Iron in Reduced Iron. GUSTAV FRERICHS (*Arch. Pharm.*, 1908, **246**, 190—205).—The process answers both for reduced and powdered iron. One gram of the sample is dissolved in 25 c.c. of dilute hydrochloric acid, and diluted to 100 c.c. Twenty c.c. of the filtrate are then mixed with 100 c.c. of water and 10 c.c. of nitric acid, and heated for some time, but not to boiling. The iron is then precipitated with ammonia, and finally weighed as oxide. Powdered iron should contain at least 98% of real iron, whilst reduced iron may be pronounced pure if it yields 96·6%. L. DE K.

Estimation of Iron by Permanganate after Reduction with Titanous Sulphate. H. D. NEWTON (*Amer. J. Sci.*, 1908, [iv], **25**, 343—345 *).—The ferric sulphate solution is reduced by means of titanous sulphate, the excess of which is rendered harmless by oxidation with bismuth oxide. The ferrous iron is then titrated with permanganate.

The titanous sulphate for this purpose may be readily prepared by fusing commercial titanic acid with potassium sodium carbonate, decomposing the mass with sulphuric acid, and reducing the solution with zinc. L. DE K.

Estimation of Ferrous Oxide in Rock Analyses. ROBERT MAUZELIUS (*Chem. Zentr.*, 1908, i, 765; from *Sveriges geol. Undersökning, Afhandl. och uppsatser.*, *Ser.* C, **206**).—In presence of titanium, the volumetric estimation of ferrous oxide still presents difficulties. On finely powdering a mineral, the ferrous oxide may have become partly oxidised; in analyses, a coarse powder should therefore be used. Rocks are best attacked with a mixture of sulphuric and hydrofluoric acids. L. DE K.

Assay of Ferrochrome with High Carbon Content. A. CAFFIN and F. DHUIQUE-MAYER (*Chem. Zentr.*, 1908, i, 986—987; from *Mon. Sci.*, 1908, [iv], **22**, 88—91).—The estimation of the chromium by fusion with sodium peroxide gives satisfactory results. The carbon is estimated by heating 0·25 gram of the powdered sample, mixed with 1·5 grams of lead peroxide and placed in a porcelain boat, for four to five hours in a porcelain combustion tube in a current of oxygen. The gases are passed through three pear-shaped absorbing flasks containing ammoniacal barium chloride solution (1 vol. of 10% barium chloride; 1 vol. of ammonia). The solution is heated for two hours on the water-bath to precipitate fully the barium carbonate, which is then converted into sulphate and weighed. Iron is estimated by fusing 0·5 gram of the powder with 5 grams of sodium peroxide, the iron is dissolved in dilute sulphuric acid, precipitated with ammonia, again redissolved in acid and reprecipitated with ammonia, and heated to redness for three hours. It is then fused with potassium sodium carbonate, dissolved in hydrochloric acid, reduced with zinc, and titrated with standard permanganate. L. DE K.

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* and *Zeitsch. anorg. Chem.* 1908, **58**, 378—380.

Electrolytic Estimation of Nickel in Nitrate Solutions and its Separation from Copper. ALFRED THIEL (*Zeitsch. Elektrochem.*, 1908, **14**, 201—208).—Nickel may be deposited quantitatively from an ammoniacal nitrate solution provided it is free from nitrite and contains a sufficient excess of ammonia. The nitrite is most readily destroyed by simple boiling; about 80 c.c. of ammonia (D 0·91) in 120 c.c. of solution are necessary to prevent the deposition of nickel oxide on the anode. Platinum anodes are dissolved unless protected by a skin of nickel oxide; this skin dissolves at the end of the operation, and the dissolved platinum is deposited at the cathode. The error due to this is avoided by using straight iron wires as anodes; the wires are brought into the passive state before use by dipping them in concentrated nitric acid, washing with alcohol, and drying. In the separation of copper and nickel, the copper is not completely precipitated at 70° if nitrous acid is present; by depositing the greater part of it at the ordinary temperature and finishing the electrolysis at 55°, this difficulty is avoided. Ammonia is then added, and the electrolysis completed with a higher current density at 70°. In presence of excess of ammonia, small quantities of nickel cannot be recognised by the addition of ammonium sulphide, since the brown colour does not appear. It is therefore advisable to continue the electrolysis for a few minutes after the first weighing of the nickel deposit in order to make sure that no further deposit occurs. T. E.

Method for the Rapid Estimation of Nickel in the Presence of Cobalt. M. EMMANUEL POZZI-ESCOT (*Bull. Soc. chim. Belg.*, 1908, **22**, 155—156 *).—The volume of the precipitate obtained on precipitating the nickel as molybdate (this vol., ii, 229) may be measured and compared with that of a known quantity of nickel molybdate in order to ascertain the amount of nickel present. The solution containing the nickel and cobalt is neutralised, concentrated, and treated with an excess of saturated ammonium molybdate solution. The mixture is placed in a tube provided with a narrow graduated neck. A mixture is also prepared with a known quantity of nickel, and is placed in a second tube. The contents of both tubes are heated, so as to cause the insoluble nickel molybdate to separate, and are then submitted to centrifugal action for three minutes, the precipitate being collected in the graduated part of the tube. The volume of the precipitate in the solution under examination is then compared with that of the known quantity of nickel molybdate. W. P. S.

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* and *Ann. Chim. anal.* 1908, **13**, 217—218.

Separation and Estimation of Nickel in the Presence of Cobalt and all other Elements which are not Precipitated by Hydrogen Sulphide in Acid Solution. M. EMMANUEL POZZI-ESCOT (*Ann. chim. anal.*, 1908, **13**, 185—186; *Bull. Soc. chim. Belg.*, 1908, **22**, 158—162).—The method of estimating nickel described previously (this vol., ii, 229) may be applied to solutions of nickel also containing cobalt, iron, zinc, manganese, chromium, uranium, aluminium, magnesium, barium, strontium, &c. The precipitate of nickel molybdate obtained is boiled with an excess of ammonia; all the nickel goes into solution, whilst the iron, aluminium, chromium, manganese, and zinc, which are also precipitated, either remain insoluble or are removed in the subsequent treatment of the nickel solution. This treatment consists in boiling the solution with potassium hydroxide in order to expel the ammonia and then adding bromine. The nickel oxide is collected on a filter, washed, dissolved in an acid, and estimated electrolytically. W. P. S.

Estimation of Vanadic and Molybdic Acids in the Presence of one Another. GRAHAM EDGAR (*Amer. J. Sci.*, 1908, [iv], **25**, 332—334 *).—The process is based on the fact that under certain conditions molybdic acid is not reduced by sulphur dioxide.

The solution, which should contain at most 0·2 gram of molybdic acid in 50 c.c. and 1 c.c. of free sulphuric acid, is heated to boiling, and a current of sulphur dioxide is passed until the vanadium is reduced to the state of tetroxide. The excess of sulphur dioxide is boiled off, and the last traces expelled by a current of carbon dioxide. The liquid is then titrated for vanadic acid with standard permanganate.

By increasing the sulphuric acid to 5 c.c., reduction of molybdic acid does not take place even with 0·4 gram of the same in 25 c.c. of liquid. L. DE K.

Reduction of Vanadic Acid by Zinc and Magnesium. FRANK A. GOOCH and GRAHAM EDGAR (*Amer. J. Sci.*, 1908, [iv], **25**, 233—238).—Glassmann's process (Abstr., 1905, ii, 208) for the titration of vanadium in presence of molybdenum is based on the assumption that a solution of vanadium when reduced by magnesium and hydrochloric acid contains V_2O_3, and that, when zinc has been employed and the solution exposed to the air, V_2O_2 is present. The authors, after having made many experiments, state that this view is quite erroneous. L. DE K.

Assay of Sulphur Antimonii Auratum. FELIX JACOBSOHN (*Chem. Zentr.*, 1908, i, 763—764; from *Gummi Zeit.*, 1908, **22**, 368—387).—Admixed sulphur may be estimated by extraction with carbon disulphide. The total sulphur is found by repeated evaporation with fuming nitric acid; the residue is then extracted with water, and treated with barium chloride as usual. The antimony is found by evaporation with nitric acid and ignition of the residue. This, however, is not pure antimony peroxide, but may contain calcium sulphate and other inert matters. The author has devised a simple and fairly satisfactory plan for an indirect estimation of the antimony, consisting in heating the residue with ammonium chloride, which causes the antimony to volatilise and does not react with calcium sulphate. The sulphur in actual combination with the antimony may be found by heating the extracted sample with hydrochloric acid and estimating the hydrogen sulphide evolved by passing it through an ammoniacal silver nitrate solution. The acid solution may then be used for further investigation. L. DE K.

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* and *Zeitsch. anorg. Chem.* 1908, **58**, 375—377.

Electrolytic Estimation of Bismuth. FLOYD J. METZGER and H. T. BEANS (*J. Amer. Chem. Soc.*, 1908, **30**, 589—593).—The solution containing at most 0·4 gram of bismuth is neutralised with sodium hydroxide, using phenolphthalein as indicator; 20 c.c. of 50% acetic acid and preferably also 2 grams of boric acid are added, and the whole is diluted to 250 c.c. and submitted to electrolysis, the conditions being about as follow: ND^2_{40} 0·2—0·15; voltage, 2·1—2·80; temperature, 74—79°; time, three-quarters of an hour to three and a half hours.

The metal is obtained quantitatively as a firmly-adhering deposit, no peroxide being deposited on the anode. L. DE K.

Influence of Microbes on the Composition of Waters. CH. ROUCHY (*J. Pharm. Chim.*, 1908, [vi], **27**, 374—380).—The chemical analysis of water, like the bacteriological examination, should be undertaken as soon as possible after the collection of the sample, on account of the chemical changes which are brought about by the bacteria contained in it. These changes consist principally in the oxidation of ammonia and of nitrites to nitrates, and stress is laid on the rapidity of this process. G. B.

Chloroform Balance. AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1908, vi—viii; *J. Physiol.*, **37**).—The principle of the balance is to weigh a closed glass bulb in an atmosphere of chloroform vapour in air. If the mixture to be administered to the animal or patient is passed through the balance case, the rise and fall of the beam, which can be registered by a pointer on a slowly moving drum, indicates changes in the percentage of the chloroform from that which it is desirable to administer. W. D. H.

Volumetric Estimation of Reducing Sugars. II. The Limits of Accuracy of the Method under Standard Conditions. ARTHUR R. LING and G. CECIL JONES (*Analyst*, 1908, **32**, 160—167. Compare Abstr., 1905, ii, 487).—The authors have subjected the method to a critical investigation, and find that it is quite as trustworthy as the gravimetric process. The average error appears to be 1 in 400 in the case of dextrose, 1 in 300 in the case of maltose, and 1 in 100 in the case of lævulose. Assuming the concentration of the sugar solution to be constant, the number of c.c. required for any titration is directly proportional to the volume of Fehling's solution employed, at all events, when this lies between the limits of 5 and 20 c.c. A table is also given showing the quantities of dextrose, lævulose, invert sugar, and maltose in 100 c.c. of solution when from 20 to 43 c.c. of the latter are required to reduce 10 c.c. of Fehling's solution. The composition of the indicator given previously (*ibid.*) requires correction; the quantity of hydrochloric acid should be 2·5 c.c. (not 50 c.c.), and the amount of ammonium thiocyanate should be increased to 1·5 grams. W. P. S.

Volumetric Estimation of Reducing Sugar. III. Estimation of Sucrose and Invert Sugar in Mixtures. ARTHUR R. LING and THEODORE RENDLE (*Analyst*, 1908, **33**, 167—170).—The influence of sucrose on the estimation of invert sugar in mixtures containing these two sugars is practically negligible until the proportion on the total sugar amounts to 30%, at which point the invert sugar is overestimated to the extent of 0·2%. In the case of a mixture of equal parts of sucrose and invert sugar, the latter would be returned as 50·4%, instead of 50%, that is to say, it would be overestimated by 0·8%, whilst a mixture containing 99% of sucrose would yield 1·14% of invert sugar on titration, or 14% too much. W. P. S.

Detection of Lævulose in Presence of other Natural Sugars. J. PIERAERTS (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **25**, 830—848).—The author has examined a number of reagents in order to ascertain whether it is possible, by their means, to detect lævulose rapidly and certainly in products containing other sugars which occur naturally, these being *l*-arabinose, *l* xylose, dextrose, *d*-mannose, *d*-galactose, maltose, lactose, sucrose, and raffinose.

The results show that, for this purpose, Fehling's solution is useless, but that certain results are given by (1) various modifications of Ost's solution containing copper sulphate, potassium carbonate, and potassium hydrogen carbonate; (2) solutions containing per litre 6 grams $Cu(OH)_2$, 50 grams (or 75 grams) $KHCO_3$, and 100 grams K_2CO_3; the second of these solutions is very stable, remaining unchanged after six months; (3) a solution containing 12 grams glycine, 6 grams cupric hydroxide, and 50 grams potassium carbonate per litre, which is also stable. Details are given for the preparation of the various solutions.

Solution (3), which yields the most satisfactory results, is not reduced in the cold in twenty-four hours by any of the reducing sugars named above with the exception of lævulose, and with this sugar the time required for reduction varies from four to nine hours, as its concentration varies from 4—5% to 1—2%. Also a 3% solution of lævulose reduces this solution in one hour at 30°, under which conditions none of the other sugars mentioned causes reduction.

These solutions may also be utilised for detecting lævulose in commercial products, such as honey, marmalade, invert sugars, &c., the preliminary procedure being as follows: 20 or 25 grams of the material are dissolved in 150—200 c.c. of cold water, the solution then being defecated by adding basic lead acetate solution drop by drop so as to avoid excess. The liquid is well shaken and filtered, the lead in the filtrate being precipitated by means of cold saturated sodium sulphate solution. After half an hour, the liquid is filtered, and the proportion of reducing sugar present estimated approximately by means of Fehling's solution. This proportion is reduced by dilution to about 5% calculated as dextrose. The presence of lævulose can then be detected as described above. T. H. P.

Evaluation of Commercial Starch. EDMUND PAROW and FRANZ NEUMANN (*Chem. Zentr.*, 1908, i, 557; from *Zeitsch. Spirit. ind.*, 1907, **30**, 561—562).—Ten grams of the sample are converted into dextrose by heating for one hour in the boiling water-bath with 20 c.c. of a solution composed of 200 grams of sodium chloride dissolved in 800 c.c. of water and mixed with 220 c.c. of 25% hydrochloric acid. Ten c.c. of basic lead acetate are added, and when cold the liquid is made up to 100 c.c. After decolorising with a little animal charcoal, the liquid is examined in a 200 mm. tube. By multiplying by a certain factor, the reading at once gives the percentage of starch. The following factors are used: For potato starch 8·288, for maize starch 8·478, for rice starch 8·497, and for wheat starch 8·420. L. DE K.

Polarimetric Estimation of Starch in Cereals, &c. ERICH EWERS (*Zeitsch. öffentl. Chem.*, 1908, **14**, 150—157).—Five grams of the finely-powdered sample are well mixed in a 100 c.c. flask with 25 c.c. of 1·124% hydrochloric acid, and the starch is then washed down from the neck of the flask by the addition of a further 25 c.c. of the same acid. The flask is immersed in a boiling water-bath for exactly fifteen minutes, the contents being shaken during the first three minutes. When the heating is finished, the contents are diluted with cold water to a volume of 90 c.c., cooled to a temperature of 20°, about 2 c.c. of a 22% sodium molybdate solution are added, the whole is diluted to 100 c.c., and filtered. The filtrate is then examined in the polarimeter, in a 200 mm. tube. Under these conditions, the reading (in degrees of the Ventzke-Soleil polarimeter) multiplied by the factor 1·892 gives the percentage of starch in the cereal. It is found that on macerating wheat flour with water for twenty-four hours, a loss of starch, varying from 2·5 to 8·5% and due to enzyme action, takes place. Maize starch also undergoes a similar loss, whilst rice starch is scarcely affected. W. P. S.

Lactic Acid in Wine. GIULIO PARIS (*Chem. Zentr.*, 1908, i, 773; from *Staz. sperim. agrar. ital.*, 1907, **40**, 689—718).—The only trustworthy method seems to be the one proposed by Partheil (Abstr., 1903, ii, 189). The author heats the lactate with concentrated sulphuric acid in a current of carbon dioxide, and collects the carbon monoxide evolved in a nitrometer over aqueous sodium hydroxide. From the volume of gas, the lactic acid is calculated. The lactic acid owes its origin mainly to fermentation of malic acid. L. DE K.

Citric Acid in Wines. A. HUBERT (*Ann. Chim. anal.*, 1908, **13**, 139—141).—Experiments showing that, as citric acid occurs naturally in wines, the addition of small quantities of this acid cannot be detected. Both Dénigès' mercury test and Moeslinger's microscopic (calcium citrate) test were employed. L. DE K.

Volumetric Estimation of Thiosulphonates. AUGUST GUTMANN (*Zeitsch. anal. Chem.*, 1908, **47**, 294—303).—The method described previously (Abstr., 1907, ii, 812) for the estimation of thiosulphates may be applied to the estimation of thiosulphonates. The filtrate from the silver cyanide and thiocyanate must be treated with an excess of zinc nitrate solution and placed aside for some time in order to precipitate sulphur compounds still remaining in solution. After adding ferric sulphate solution, the excess of silver is then titrated in the usual way. The zinc-sulphur compound is not removed before the titration, as it is insoluble and without effect on the operation. The reaction proceeds according to the equation: $R'SO_2SM' + KCN = R'SO_2M' + KCNS$, where R′ is an organic radicle and M′ a univalent metal. One litre of *N*/10 silver nitrate solution corresponds with 0·1 molecule of thiosulphonate. W. P. S.

Estimation of Fat, &c. in Animal Tissues. JOHAN C. BERNTROP (*Biochem. Zeitsch.*, 1908, **10**, 192).—A reply to Kumaga and Sutō (this vol., ii, 331). A claim for priority with regard to an extraction apparatus (Abstr., 1902, ii, 366). S. B. S.

Colour Reactions of the Toxic Glucosides of Digitalis. LÉON GARNIER (*J. Pharm. Chim.*, 1908, [vi], **27**, 369—371).—Comparison of the reactions of Kiliani, modified by Keller, of Brissemoret and Derrien, and of Lafon. All three give a coloration with crystalline digitoxin, but only the first two with amorphous digitalin. G. B.

Gall-Iron Inks. F. WILLY HINRICHSEN and ERICH KEDESKY (*Chem. Zentr.*, 1908, **1**, 990—991; from *Mitt. K. Materialprüfgs.-Amt.*, **25**, 244—261).—In technical ink analysis, where the gallic acid is only about 1/5 of the total gallo-tannins, it may be assumed that the iodometric estimation gives the same value for gallic as for tannic acid. The joint acids are best obtained by extraction with ethyl acetate. The titration should be carried out in presence of sodium hydrogen carbonate, 2 grams for every 0·1 gram of tannins supposed to be present. After eighteen hours, the excess of iodine is titrated with thiosulphate. A blank experiment should be made, as the sodium hydrogen carbonate itself absorbs iodine to a slight extent.

L. DE K.

General and Physical Chemistry.

Refractive Indices of Gaseous Nitric Oxide, Sulphur Dioxide, and Sulphur Trioxide. CLIVE CUTHBERTSON and E. PARR METCALFE (*Proc. Roy. Soc.*, 1908, *A*, **80**, 406—410).—The refractive index of nitric oxide for sodium light is 1·0002939. This is greater than the value calculated from the indices of nitrogen and oxygen. For sulphur dioxide and trioxide, the values of the index are respectively 1·0006609 and 1·000737. These numbers are much smaller than those calculated from the indices of sulphur and oxygen.

H. M. D.

Refractive Index and Dispersion of Light in Argon and Helium. W. BURTON (*Proc. Roy. Soc.*, 1908, *A*, **80**, 390—405. Compare Scheel and Schmidt, this vol., ii, 333).—The measurements were made by Jamin's interferometer method. The refractive index for the D_1 line at 0° and 760 mm. is for argon 1·0002837; for helium, 1·00003500. The constants A and B in the dispersion equation $n = A + B/\lambda^2$ are for argon 1·0002792 and $1{\cdot}6 \times 10^{-14}$; for helium, 1·00003478 and $7{\cdot}5 \times 10^{-16}$. H. M. D.

Dispersion of Gaseous Mercury, Sulphur, Phosphorus, and Helium. CLIVE CUTHBERTSON and E. PARR METCALFE (*Proc. Roy. Soc.*, 1908, *A*, **80**, 411—419. The results obtained for the refractive index and dispersion can be expressed by the formulæ: mercury, $\mu - 1 = 0{\cdot}001755\ (1 + 2{\cdot}265/\lambda^2.10^{10})$; sulphur, $\mu - 1 = 0{\cdot}001046\ (1 + 2{\cdot}125/\lambda^2.10^{10})$; phosphorus, $\mu - 1 = 0{\cdot}001162\ (1 + 1{\cdot}53/\lambda^2.10^{10})$; helium, $\mu - 1 = 0{\cdot}0000347\ (1 + 2{\cdot}4/\lambda^2.10^{11})$. The refractive index of sulphur for infinitely long waves is, within 2%, four times that of oxygen; the dispersions also are approximately as 4 : 1. The index of phosphorus for infinitely long waves is exactly four times that of nitrogen; the dispersions are almost exactly as 2 : 1. The index of helium is, within 1·6%, one-eighth of that of argon. H. M. D.

Energetics and Chemistry of Banded Spectra. JOHANNES STARK (*Physikal. Zeitsch.*, 1908, **9**, 356—358. Compare this vol., ii, 138).—Polemical against Kauffmann (*Physikal. Zeitsch.*, 1908, **9**, 311). The nitro-compounds mentioned by Kauffmann as forming exceptions to the author's view of the dependence of fluorescence on the position of the absorption bands are not suitable substances for the examination of the validity of the theory; absorption bands due to groups other than the nitro-group condition the fluorescence of these substances. H. M. D.

The Spectra of Oxygen (Doppler Effect with Canal Rays). JOHANNES STARK (*Sitzungsber. K. Akad. Wiss. Berlin*, 1908, 554—577). —The canal rays in oxygen have been examined, and it is found that three of the series lines show the Doppler effect, although only under specially favourable conditions. The spark lines show the effect the more strongly the greater their intensity. Bands are also conspicuous in the canal ray spectrum of oxygen.

The observations on canal rays in different elements lead to the conclusion that the carriers of the line spectra are the positive ions. It appears also that by the loss of one or more electrons, an atom may give rise to positive ions of different valency. C. H. D.

The Distribution of Intensity in the Spectra of the Canal Rays in Hydrogen. JOHANNES STARK and W. STEUBING (*Sitzungsber. K. Akad. Wiss. Berlin*, 1908, 578—585).—The relation between the distribution of intensity of spectral lines in canal rays and the velocity of the rays has been investigated. With increasing velocity the ratio of the intensity of a line to that of a less refrangible line of the same series increases the more rapidly the smaller the ratio of the wave-lengths of the two lines. C. H. D.

The Resonance Spectra of Sodium Vapour. ROBERT W. WOOD (*Phil. Mag.*, 1908, [vi], **15**, 581—601*).—Sodium vapour in an exhausted steel tube, heated to about 400°, shows an extremely complex absorption spectrum consisting of a multitude of very fine absorption lines; the very large scale photographs taken show, for example, about 6000 lines in the bluish-green. If the vapour is illuminated with white light, it becomes fluorescent and gives an emission spectrum which is the exact counterpart of the absorption spectrum. By exciting the vapour with monochromatic light, only a few lines appear in the emission spectrum. These spectra are called "resonance spectra," because they appear to be due to resonance of an electron of the system when monochromatic radiation plays upon it. The principal peculiarities of the resonance spectra are: (1) they always contain a line of the wave-length of the exciting line; (2) they contain one or more series of other lines spaced almost equally; the lines are usually 38 to 39 Ångström units apart. The bluish-green lithium line ($\lambda = 4972$) excites the same series of lines as the barium line 4934. Only light of certain wave-lengths can excite the resonance spectra, for example, the line 5209 is the only one in the spectrum of the silver arc which is active. The electron theory indicates that a non-radiating system of electrons, when disturbed by absorption of radiation of the same frequency as that of one of the electrons, should emit radiations giving a system of equally spaced lines.

Another remarkable spectrum is obtained by exciting the vapour with cathode rays; this is being studied in detail. T. E.

The Long Wave-length Portion of the Barium Spectrum. VICTOR HOELLER (*Zeitsch. wiss. Photographie Photophysik Photochem.*, 1908, **6**, 217—234).—The arc spectrum of barium has been photographed between λ 5160 and λ 7090, the first order being employed and compared with the ultra-violet iron spectrum in the second order. A number of new lines are recorded. The bands between λ 5800 and λ 6600 have also been studied, Fabry's formula being found best to express the relations of the oscillation-frequencies. The weak lines in the bands are very numerous, and it was found necessary to compute the position of the heads of the bands.

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* And *Physikal. Zeitsch.* 1908, **9**, 450—461.

A comparison with the spectra of the alkaline earths leads to the conclusion that the bands in the barium spectrum are due to the metal, and not to the oxide. C. H. D.

The Spectrum of Iron Observed in the Oxyhydrogen Blowpipe Flame. Gustave A. Hemsalech and Charles de Watteville (*Compt. rend.*, 1908, **146**, 962—965).—The method previously described for studying the spectrum of iron in a hydrogen flame (this vol., ii, 336) has been adapted to the study of spectra in the oxyhydrogen flame. Oxygen was passed through a bulb containing iron electrodes between which extremely powerful electric sparks were discharged. The issuing gas was mixed with hydrogen in the burner previously described, and produced a very white and brilliant flame.

Both the visible and the ultra-violet parts of the spectrum were examined, about 200 lines being identified and their relative brightness determined. Some of the ultra-violet lines were obscured by the bands of the water-vapour spectrum.

In the spectrum of iron at the oxyhydrogen flame temperature, there appears to be a concentration of energy between the wave-lengths 3500 and 3900. When air is substituted for oxygen, not only is the general brightness of the spectrum diminished, but the relative intensity of the lines is altered. The lines of the oxyhydrogen flame are those which appear brightest in the arc spectrum of iron, but the relative intensities are different in this case also. The brightest line from the blowpipe flame is 3860·03, whilst the brightest from the arc is 4383·70.

Practically all the lines attributed to iron in the spectrum of the star Sirius have been found in the blowpipe spectrum except the lines of "proto-iron" ("enhanced lines") described by Lockyer.

R. J. C.

Influence of Temperature and Magnetisation on Selective Absorption. Henri E. J. G. Du Bois and G. J. Elias (*Proc. K. Akad. Wetensch. Amsterdam.* 1908, **10**, 839—850).—In continuation of previous work (this vol., ii, 336), the absorption spectra in the visible region of certain solid compounds of chromium, uranium, praseodymium, neodymium, samarium, and erbium have been further examined, mostly at 193°. The effect of magnetisation in resolving and shifting the position of the lines at 193° has been examined, the results for the green, yellowish-green, and red regions of the spectrum of erbium nitrate being given in considerable detail. G. S.

Application of Optical Properties of Liquids to the Study of Polymerisation and Analogous Phenomena. N. N. Andréeff (*J. Russ. Phys. Chem. Soc.* (*Phys.*), 1908, **40**, 191—201).—Substances which, like tartaric acid, exhibit anomalous rotatory dispersion without absorption are regarded as consisting of at least two kinds of molecules having opposite rotatory powers. The author describes a method by which the number of different kinds of molecules may be determined in this and similar cases.

If q represents any additive property, for example, the rotation of a substance containing molecules of two different kinds, then $Pq = a_1 q_1 + a_2 q_2$ and $P = a_1 + a_2$, where q_1 and q_2 are the respective values of this property for the two kinds of molecules and P, a_1, and a_2 denote the total weight and the weights of the different molecules respectively. The values of q_1 and q_2 depend only on the wave-length of the light employed, whilst a_1 and a_2 vary only with external conditions, such as the temperature. Hence at three different temperatures, with which correspond the values a_1' and a_2', a_1'' and a''_2, and a_1''' and a_2''', the three following pairs of equations hold:

$$(1)\ q' = a_1' q_1/P + a_2' q_2/P\ ;\ a_1' + a_2' = P\ ;$$
$$(2)\ q'' = a_1'' q_1/P + a_2'' q_2/P\ ;\ a_1'' + a_2'' = P\ ;$$
$$(3)\ q''' = a_1''' q_1/P + a_2''' q_2/P\ ;\ a_1''' + a_2''' = P.$$

From these, it can be readily calculated that $(q'' - q')/(q''' - q') = (a_1'' - a_1')/(a_1''' - a_1')$, so that $(q'' - q')/(q''' - q')$ is independent of the wave-length. The constancy of this expression for different wave-lengths is hence a criterion for the presence of two kinds of molecules in the substance investigated.

By applying this method to the rotations of tartaric acid, and of dimethyl, diethyl, and dipropyl tartrates for light of various wave-lengths, the author finds that each of the substances contains molecules of two different types.

On the above lines, the author has developed a general theory which leads to a number of determinants, δ_1, δ_2, δ_3, ... δ_n; and it is shown that if δ_n is the first of these which has the value zero, the substance contains molecules of n different kinds possessing other than zero values for the optical property considered. T. H. P.

Relation Between the Rotatory Power of Optically Active Compounds and their Chemical Structure. II. D. A. CHARDIN (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 592—598. Compare Abstr., 1907, ii, 830).—In the present paper is described the investigation of the hexyl alcohol, $CHMeEt\cdot CH_2\cdot CH_2\cdot OH$, the corresponding bromide, $CHMeEt\cdot CH_2\cdot CH_2Br$, and the hexylbenzene,

$$CHMeEt\cdot CH_2\cdot CH_2Ph,$$

on the lines indicated in the previous communication.

From the values of the specific rotation of the hexyl alcohol, the atomic product for oxygen is calculated to be 129·28, the number obtained from a study of active amyl alcohol being 132·32 and the theoretical value 139·4.

Taking the number 211·9 for the atomic product of bromine (*loc. cit.*), the value of $[\alpha]_D^{142\cdot5}$ for the hexyl bromide is calculated to be +15·23°, which deviates from the actual experimental number, +14·48°, by about 5%; if, however, the reverse calculation is made from the rotation +14·48°, the atomic product for bromine becomes 130·4, which differs from the theoretical value, 211·9, by about 38·5%.

Consideration of the numbers obtained for the hexyl benzene indicates that the linkings of the hydrogen to the carbon atoms in benzene do not lie in the plane of the ring, but perpendicular to that plane, as suggested by Erlenmeyer, jun. T. H. P.

Anomalous Magnetic Rotation (of the Plane) of Polarisation of the Rare Earths. G. J. Elias (*Physikal. Zeitsch.*, 1908, **9**, 355).—In reference to Wood's investigation of the anomalous magnetic rotation of neodymium (*Phil. Mag.*, 1908, [vi], **15**, 270), the author recalls a similar phenomenon already observed by him in the case of a solution of erbium chloride. H. M. D.

Triboluminescence of Mineral Substances. Adrien Karl (*Compt. rend.*, 1908, **146**, 1104—1106).—The triboluminescence of many mineral substances is only observed when the eye has become sensitised by a prolonged sojourn in the dark. In other cases, excessive resistance to fracture, or great fragility, has prevented the detection of this property. Triboluminescence is similar to phosphorescence in that it requires the presence of large quantities of a diluent with small quantities of a triboluminogen. Pure substances are not triboluminescent. A triboluminescent system almost always retains the property when subjected to chemical change; thus a triboluminescent manganiferous zinc oxide retains the property when transformed into nitrate or sulphate; the fluoride, however, is inactive.

The study of series of mixtures indicates the existence of an optimum proportion of triboluminogen. These optima are quite different from those of cathodic phosphorescence for the same mixtures. The persistence of triboluminescence in spite of repeated fractionation is very great for some diluents, but purification leads finally to a disappearance of the property.

In the mixtures studied, the diluent was zinc sulphide or oxide, and the triboluminogens, oxides and sulphides of silver, lead, tungsten, tin, bismuth, copper, cadmium, nickel, manganese, uranium, tantalum, niobium, thorium, iron, chromium, zirconium, barium, calcium, vanadium, praseodymium, samarium, dysprosium, magnesium, and silicon. Intimate admixture was effected by simultaneous precipitation or evaporation of the mixed solutions.

The colour of the emitted light varies with the triboluminogen, and is also influenced by the diluent; thus lead gives blue and manganese orange; the system (TiO_2,ZnO) has a pale violet triboluminescence, whilst that of (TiO_2,ZnS) is dark green. The colour is different from that of the phosphorescence of the same mixtures. E. H.

Electrochemistry of Light. II. Wilder D. Bancroft (*J. Physical Chem.*, 1908, **12**, 318—376. Compare this vol., ii, 448).—In the present paper, the mode of action of sensitisers is discussed, the available data being adduced in the form of extracts from the writings of Eder, Vogel, Abney, Timiriazeff, Bothamley, and others. A distinction is drawn between optical sensitisers, which make silver bromide sensitive for certain rays of the spectrum on account of their optical absorption bands, and chemical sensitisers, which are mainly effective by reacting chemically with iodine and bromine.

As to the mode of action of dyes as sensitisers, Abney's view that the dye is oxidised by light is not in accord with the experimental facts, and Eder's suggestion that the dye acts as a catalytic agent is in many respects unsatisfactory. The only theory which accounts satisfactorily for the facts is that of Grotthuss, according to which sensitisers act directly or indirectly as depolarisers. All sensitisers are sensitive to light, and are either reducing agents in the wide sense of the term or are converted into reducing agents by light. The mode of action of cyanin and the eosin dyes as sensitisers is discussed.

There is no connexion between sensitising power and fluorescence.

G. S.

Radioactivity. WILLY MARCKWALD (*Ber.*, 1908, **41**, 1524—1561).—A lecture delivered to the German Chemical Society. G. Y.

Radioactivity. ANDRÉ DEBIERNE (*Bull. Soc. chim.*, 1908, [iv], **3**, i—xxxix).—A lecture delivered to the French Chemical Society.

J. C. C.

Law of Transformation in Stages and Radioactivity. GERHARD C. SCHMIDT (*Jahrb. Radioaktiv. Elektronik.*, 1908, **5**, 115—119).—The successive formation of disintegration products of the various radioactive substances is supposed to be due to the operation of the general law, according to which the spontaneous transformation of any substance is determined by the least possible diminution of free energy. In consequence of this law, it is improbable that more than one α-particle is emitted in each stage of the disintegration process.

H M. D.

Radioactivity of Water from Martos and Onteniente. FAUSTINO DIAZ DE RADA (*Anal. Fis. Quim.*, 1908, **6**, 290—291).—The following table shows the character of the water from the localities named:

Locality.	Spring.	Temperature.	Initial activity, volts per hour-litre.
Martos	—	20—22°	30·4
Onteniente	El Principal	—	45·8
,,	El Pocito	—	74·8

W. A. D.

Radioactivity of Water from Castromonte and Puertollano. JOSÉ MUÑOZ DEL CASTILLO (*Anal. Fis. Quim.*, 1908, **6**, 291—292).—The following table shows the character of the different samples of water:

Locality.	Spring.	Temperature.	Initial activity, volts per hour-litre.
Puertollano	Fuente de San Gregorio	16·25°	138·1
,,	Los Baños	20°	44·7
Castromonte	—	—	73·5

W. A. D

Ionisation Phenomena Produced by Snow. G. Costanzo and C. Negro (*Jahrb. Radioaktiv. Elektronik.*, 1908, **5**, 120—124).—In the expectation that the emanation emitted by the earth's surface would give rise to an abnormally large ionisation of the air contained in layers of fallen snow, the authors have examined such air electroscopically. Whereas the normal fall of potential amounted to 0·2 volt in five minutes, the voltage drop when the air from 25 grams of collected snow was allowed to circulate through the apparatus amounted to 3·5 volts in the same interval. After sixteen hours, when the snow was melted, the fall of potential under the same conditions was 0·5 volt in five minutes. The ordinary air after the snow-fall was found to contain relatively few ions; this is supposed to be due to the ions previously present having acted as centres of condensation. H. M. D.

Distribution of the Radiation of Radioactive Substances. H. Greinacher (*Physikal. Zeitsch.*, 1908, **9**, 385—392).—The darkening of photographic plates subjected to the action of metallic uranium, which is cut so as to give plane geometrical figures, shows a peculiar distribution. In general, the darkening extends beyond the uranium itself, but at each angle the plate shows a region where the effect is very greatly reduced. The contrast is greater in the case of acute angles than for angles which are obtuse. Experiments are described which show that the phenomenon cannot be attributed to total reflection or to mutual action of the β- and γ-rays resulting in deflexion. Geometrical figures cut from a hardened mixture of uranium oxide and gypsum show the effect described with the same sharpness, and when minium, which readily absorbs β-rays but radiates secondary rays in large quantities, is added to the mixture of uranium oxide and gypsum, very sharply-defined images are obtained. The phenomenon is supposed to be due to secondary rays produced by the β- and γ-rays, and it is shown that the images produced on the photographic plates are displaced under the influence of a strong magnetic field. H. M. D.

Life of Radium. Bertram B. Boltwood (*Amer. J. Sci.*, 1908, [iv], **25**, 493—506).—The growth of radium in solutions of ionium has been examined by measuring the emanation contained in the solutions at different times. Five different solutions of ionium were used in the experiments. The first two were obtained from carnotite, the third from Joachimsthal uraninite, the fourth from secondary uranium minerals, chiefly gummite and uranophane, and the fifth from a specimen of very pure uraninite from North Carolina. The amounts of radium produced by the separated ionium in known periods are compared with the quantities of radium originally associated with the quantities of the various minerals operated on, and from these data the disintegration constant of radium is calculated to be $3 \cdot 48 \times 10^{-4}$ (year)$^{-1}$. The separate values obtained for the five different solutions are in good agreement, and the half-value period corresponding with this constant is about 2000 years. H. M. D.

Distribution in Electric Fields of the Active Deposits of Radium, Thorium, and Actinium. SIDNEY RUSS (*Phil. Mag.*, 1908, [vi], **15**, 601—614).—A rod charged either positively or negatively to 300 volts is exposed to a definite quantity of the emanation of radium, thorium, or actinium mixed with another gas, and the quantities of active deposit compared when the pressure of the admixed gas is varied. With radium emanation in air, the activity of the negative rod diminishes slowly with the pressure at about 100 mm., but much more rapidly at lower pressures, whilst that of the positive rod increases slightly. The ratio of the activities is about 20 at atmospheric pressure, and about 2·5 at 0·01 mm. In sulphur dioxide the difference of activity is much greater, whilst in hydrogen there is no difference at all up to 1 mm. pressure. With thorium emanation in air, the ratio of the activities of the negative and positive rods is about 200 : 1 at atmospheric pressure, and about 25 : 1 at 2 mm., the change being due to a diminution in the activity of the negative rod. With actinium, the ratio is 2 : 1 at atmospheric pressure, but at 2 mm. pressure it is 22·1, the activity of the negative wire increasing. The ratio in the case of actinium increases, however, as the distance of the electrodes from the actinium becomes smaller. The experiments confirm Rutherford's view that the molecules of the active matter are moving too fast to be directed by the electric field unless they are stopped by numerous collisions with other gas molecules. The experiments with actinium indicate that the sign of their electric charge depends on the distance they have travelled through the gas. T. E.

Determination of the Molecular Weight of Radium Emanation by the Comparison of its Rate of Diffusion with that of Mercury Vapour. P. B. PERKINS (*Amer. J. Sci.*, 1908, [iv], **25**, 461—473).—An apparatus is described by means of which the rates of diffusion of mercury vapour and radium emanation have been compared at temperatures of 250° to 275°. The tendency of mercury to oxidise at this temperature made it necessary to carry out the diffusion experiments in an atmosphere of hydrogen. The porous plugs through which the gases diffused were made by boring a large number of cup-shaped holes, 1 mm. in diameter, through an iron tube which divided the apparatus into two chambers; these holes were then filled with fine asbestos fibre. The quantities of diffused emanation were measured by determining the amounts of the induced activity on a negatively charged electrode.

It is pointed out that Graham's law can only be applied with accuracy to the determination of molecular weights when the molecular complexity of the two gases compared is the same, and when the molecular weights do not differ very much from one another. These conditions are fulfilled in the comparative experiments made by the author.

From a number of experiments at 250°, the molecular weight of the emanation is found to be 235; from the experiments at 275°, the calculated value is 234. The author concludes that there can be no doubt that the molecular weight of the emanation is not very different from that of radium. H. M. D.

Different Kinds of γ-Rays of Radium and the Secondary γ-Rays which they Produce. R. D. KLEEMAN (*Phil. Mag.*, 1908, [vi], 15, 638—663).—When the γ-rays of radium fall on a substance, secondary γ-rays are given off. It is shown that the primary γ-rays consist of at least three groups of rays. Group *A* is most readily absorbed by lead and mercury, group *B* by zinc, copper, iron, sulphur, and aluminium, and group *C* by carbon. The secondary γ-rays radiated from these substances consist mainly of the two groups which are least absorbed by the substance. The best absorbed group of primary rays produces secondary rays, which are still more readily absorbed, and so do not escape from the substance. The explanation of the phenomena on the hypothesis that γ-rays are pulses in the ether produced by changes in the velocity of corpuscles is discussed. T. E.

The Range of the α-Rays. WILLIAM DUANE (*Compt. rend.*, 1908, **146**, 958—960).—It is well known that the ionising, phosphorescent, and photographic activities of α-rays are completely destroyed when the rays traverse a few centimetres of air or an equivalent thickness of some other substance. Rutherford found that the velocity of the α-rays near the end of their course is reduced to 60% of its initial value. The quantity of positive electricity carried by the α-rays of radium is now shown to be similarly affected by the interposition of air.

The apparatus employed consisted of an electrode contained in a cylindrical brass box which could be evacuated. The α-rays were allowed to enter the end of the box through a window made of extremely thin mica supported on copper gauze. The gauze was insulated from the box and electrode, and connected to a battery, so that the ionising effect of the rays could be measured by the conductivity of the air between the window and the electrode.

For ionisation measurements, a minute quantity of radium chloride was purified from emanation and from induced activity by dissolving in water twice, and was finally dried on a piece of platinum foil. The foil bearing the radium was placed at a known distance from the mica window of the box, and the current carried between the charged gauze and the electrode by the ionised air was measured by a quadrant electrometer. Practically the whole ionisation of the air within the box ceased when the radium was removed 2 cm. from the window. The small ionisation which persists even at longer ranges was attributed to traces of induced activity and emanation remaining in the radium chloride. When the chloride was left for two days so that emanation and induced activity accumulated, it produced considerable ionisation in the box even when 4 cm. from the mica window.

A much larger quantity (almost 0·002 gram) of radium chloride, purified by solution in water as before, was employed to measure the quantity of electricity transported to the electrode by the α-particles.

The box containing the electrode was now evacuated, so that no ionisation current could pass between the window and the electrode, and the charge carried by the α-rays themselves to the electrode was measured with a Wilson electroscope. Secondary radiation towards the electrode was suppressed by placing the apparatus in a strong magnetic field parallel to the electrode. It was found that if the radium was more than 2 centimetres from the mica window, no charge was carried through to the electrode. If the radium was not free from emanation and induced activity, however, the charge could be detected at much greater distances, but could not be attributed to the α-particles.

The charge of the α-particles and their ionising effect are stopped by practically the same thickness of air, namely, 2 centimetres.

R. J. C.

Secondary Rays from the α-Rays. William Duane (*Compt. rend.*, 1908, **146**, 1088—1090).—It has been shown previously (preceding abstract) that the charge carried by the α-rays of radium stops at the place where the ionising, photographic, and phosphorescent effects disappear. The experiments now described indicate that the α-rays lose their power of producing secondary rays at the same point. The brass box, containing an electrode and fitted with a mica window, described in the first paper, was again employed. When the radium salt is sufficiently near to the mica window, the α-rays pass through the latter and strike the electrode, producing secondary rays on the surfaces both of the mica and of the electrode. The charge of these secondary rays can be readily measured by evacuating the box and determining the potential of the electrode by means of a Wilson electroscope. If a is the positive charge carried to the electrode per second by the α-rays, s_1 the negative charge removed from the electrode per second by the secondary rays leaving its surface, and s_2 the negative charge carried to the electrode by the secondary rays from the mica window, then the total current i towards the electrode is $i = a + s_1 - s_2$. A large enough magnetic field parallel to the surface of the electrode suppresses s_1 and s_2, whilst an electric field produced between the mica window and the electrode stops either s_1 or s_2 according to its sense. Thus, in order to determine the current s_1 due to the secondary rays leaving the electrode, it is sufficient to measure, firstly, the current $(a + s_1)$, s_2 being eliminated by an electric field, and, secondly, the current a, s_1 and s_2 being suppressed by a magnetic field.

When the radium is placed 1·4 cm. below the mica window, and the latter is charged at different potentials, the current obtained does not increase after the potential has risen to 85 volts, showing that this is sufficient to stop all the secondary rays s_2; moreover, the high potential required for this purpose indicates that the currents are not due to ionisation of the gas remaining in the apparatus.

Radium almost free from emanation and induced activity (as in the former experiments) was placed at different distances below the window, and the currents measured (1) with the window at a potential of +85 volts, and (2) with a magnetic field of 2800 gauss. The difference of these two currents, representing the charge of the secondary rays, is plotted as a function of the distance of the radium, and the curve obtained shows that the production of secondary rays ceases almost completely when the radium is more than 2 cm. below the mica, that is, the distance at which the other effects of the α-rays disappear.

Similar experiments with polonium gave inconclusive results, owing to the minuteness of the currents produced. E. H.

Method of Counting the Number of α-Particles from Radioactive Matter. ERNEST RUTHERFORD and H. GEIGER (*Mem. Manchester Phil. Soc.*, 1908, **52**, No. 9, 1—3).—It should be only just possible with very sensitive apparatus to detect the ionisation of a gas produced by a single α-particle, but by making use of the property of ions moving in a strong electric field in a gas at low pressure of producing a number of fresh ions by collision with the gas molecules, the authors have succeeded in automatically increasing the electrical effect several thousand times and rendering it easily observable. The testing vessel was a long brass tube, along the axis of which a thin insulated wire passed which was connected to the electrometer, the gas pressure being about 2 cm. A potential difference of about 1000 volts between the brass tube and the wire was required. From a film of active matter contained in an exhausted tube, which is a prolongation of the testing vessel, the α-particles were fired through a small hole covered by a mica plate at the rate of from six to ten per minute. The effect of the α-particle entering the testing vessel was shown by a sudden throw of the electrometer needle, and by observing the number of throws it was found that the number of α-particles counted by this method is of the same order as the calculated number. By counting at intervals the number of α-particles expelled per minute, the curves of decay of activity of a plate coated with radium-*C* or actinium-*B* have been obtained. The time interval between the entrance of successive α-particles has been observed over a long interval, and the results show that the distribution curve with time is similar in general shape to the probability curve of distribution of the velocity of molecules in a gas. Further observations are in progress.

J. V. E.

Changes in Velocity in an Electric Field of the α, β, and Secondary Rays from Radioactive Substances. A. S. EVE (*Phil. Mag.*, 1908, [iv], **15**, 720—737. Compare Abstr., 1905, ii, 4; H. W. Schmidt, Abstr., 1907, ii, 520).—The author withdraws his previous statement that the secondary rays from substances acted on by the β- and γ-rays of radium are homogeneous. Corrected values for the coefficients of absorption by aluminium of the secondary rays emitted by different substances are given. The experimental data for lead, iron, brick, and carbon indicate that the rays from the lighter substances are more easily absorbed, especially at first. The lighter the substance the less is the secondary radiation, and the smaller the group velocity of the secondary rays the more quickly are these absorbed by the screens. The secondary rays from lead are very similar to the primary radium rays which produce them.

Certain substances, such as brick, slate, wood, paper, and carbon, give rise to very penetrating secondary rays, which originate from layers of the radiator several centimetres deep; these appear to be secondary γ-rays or high velocity negative rays.

It is shown that the velocity of the α, β, and secondary rays can be increased or diminished in a strong electric field the lines of force of which are parallel to the direction of motion of the rays. In the case of the α-particles, there also appears to be a small change in the range of the particles. Experiments on the influence of the electric field on the secondary radiations emitted by different radiators show that these are influenced to varying extents. The changes produced in the group velocity of the secondary rays on reversal of a given field increase as the coefficient of absorption by aluminium increases, and, in consequence, as the density of the radiator diminishes.

These results indicate that the secondary rays are in the main intrinsic, and are emitted with distinctive group velocities depending on the density of the radiator. They are not due to dispersed primary rays, although it is not improbable that a certain fraction of the secondary radiation may consist of such primary rays. H. M. D.

Experimental Investigation of the Nature of γ-Rays. William H. Bragg and J. P. V. Madsen (*Phil. Mag.*, 1908, [iv], 15, 663—675).—An ionisation chamber is closed above by super-imposed plates of different metals (for example, lead and aluminium), the bottom being made of a similar pair of plates. A pencil of γ-rays traverses all four plates, entering at the top. Reversing the top pair of plates makes very little difference in the ionisation in the chamber; reversing the bottom pair, increases it in a very marked way when the lead plate is uppermost. The ionisation is mainly due to secondary radiations from the metal surfaces within the chamber. On the ether pulse theory, the radiation set up by a pulse entering a substance should be the same as that produced on leaving it. The experiment shows that this is not so. The authors propose the hypothesis that γ-rays are material, and consist of neutral pairs formed from β-rays by taking up a positive charge. The secondary radiation, which is known to contain β-rays, would be produced by the γ-ray losing its positive charge again. The same hypothesis applies to *X*-rays. T. E.

Electrical Charge of the Active Deposit of Actinium. Sidney Russ (*Phil. Mag.*, 1908, [iv], 15, 737—745).—It has been found that the relative activities of positively and negatively charged plates which are symmetrically exposed to the action of actinium emanation depend on the distance between the actinium and the charged plates, and also on the pressure.

At 760 mm. pressure, the ratio of the activity of the negative to that of the positive plate diminishes as the distance of the plates from the actinium increases; at 2 mm. pressure, the opposite relationship holds good. At the higher pressure, the active matter deposited on the negative plate decreases regularly with increasing distance from the actinium, whereas that deposited on the positive plate increases at first and then decreases. At the lower pressure, the active matter on the negative plate increases with the removal of the plate from the actinium, whilst that on the positive plate shows a steady decrease.

Experiments with an apparatus which permitted of measurements at longer distances were made at a pressure of 12 mm. It was found in these circumstances that the ratio of the negative to the positive activity first increases and then diminishes.

The author concludes that the electrical charge exhibited by the active deposit particles is mainly determined by the collisions between these particles and the ions or molecules of the gas with which they are in contact. H. M. D.

Number of Quasi-elastic Bound Electrons in the Helium Atom. H. ERFLE (*Ber. deut. physikal. Ges.*, 1908, **6**, 331—338).—From Herrmann's measurements of the dispersion of helium, the author calculates a lower limiting value (p) for the number of quasi-elastic bound electrons in the helium atom. It is shown that there is probably only one type of electron with a vibration frequency corresponding with the ultra-violet region. The corresponding wave-length is 113 $\mu\mu$, and the calculated limiting value of the number of the electrons under consideration represents in this case the actual number. Since p is equal to 0·25, it follows that the number of helium atoms in a given volume of the gas is four times as large as the number of quasi-elastic bound electrons in the same volume.

H. M. D.

Meso-thorium. OTTO HAHN (*Physikal. Zeitsch.*, 1908, **9**, 392—402).—An account of work, most of which has been already published (compare Abstr., 1907, ii, 359, 664). The changes observed in the activity of commercially-purified thorium preparations, from which meso-thorium is separated by the processes of purification, depend on whether the changes are followed by measurements of the quantity of emanation emitted, or whether the α-rays are examined. The difference is traced to the fact that thorium itself emits α-rays. When the constant α-radiation of thorium is taken into account, the activities of thorium preparations of different ages, measured by both methods, are in good agreement with the activities calculated on the basis of the constants of meso-thorium and radio-thorium.

The α-ray activity of meso-thorium, free from radio-thorium, has been observed during a period of one and a-half years. The observed increase in the activity agrees with that required by the known constants of meso- and radio-thorium. All the later experiments confirm the previous statement that meso-thorium emits β-rays but not α-particles. H. M. D.

Electrical Conductivity of Alloys and their Temperature Coefficients. W. GUERTLER (*Physikal. Zeitsch.*, 1908, **9**, 404—405).—Polemical against Rudolfi (*Physikal. Zeitsch.*, 1908, **9**, 198).

H. M. D.

Aluminium in the Potential Series. Charles M. van Deventer and H. van Lummel (*Chem. Weekblad*, 1908, 5, 359—363; Johannes J. van Laar, *ibid.*, 383, 390).—Polemical (compare van Deventer and van Lummel, this vol., ii, 12; van Laar, this vol., ii, 248).

A. J. W.

Galvanic Self-induction of Metals. Charles M. van Deventer and H. van Lummel (*Chem. Weekblad*, 1908, 5, 349—356. Compare van Deventer and van Lummel, this vol., ii, 12).—The authors describe experiments with zinc, cadmium, tin, lead, nickel, copper, silver, and platinum in support of their theory of the "leaking insulator." A. J. W.

Dielectric Constants of Gases at High Pressures. Karl Tangl (*Ann. Physik*, 1908, [iv], 26, 59—78).—The dielectric constants of hydrogen, nitrogen, and air have been measured at pressures varying from 20 to 100 atmospheres. The values for 20, 40, 60, 80, and 100 atmospheres are for hydrogen at 20°: 1·00500, 1·00986, 1·01460, 1·01926, and 1·02378; for nitrogen at 20°, 1·01086, 1·02185, 1·03299, 1·04406, 1·05498, and for air at 19°, 1·01080, 1·02171, 1·03281, 1·04386, and 1·05494 respectively.

The Clausius-Mossotti formula holds good up to 100 atmospheres; the extrapolated value of the dielectric constant for 1 atmosphere and 0° is equal to the square of the refractive index for infinitely long wave-lengths in the case of all three gases examined.

The dielectric constant of mixtures of hydrogen and nitrogen (D_m) is given by the equation $D_m - 1 = (D_H - 1) + (D_N - 1)$, where D_H and D_N are the dielectric constants for the two gases at the pressures in which they are contained in the mixture. H. M. D.

Reactions in the Iron-Nickel Peroxide Accumulator. II. Behaviour of the Electrolyte. Fritz Foerster (*Zeitsch. Elektrochem.*, 1908, 14, 285—298. Compare this vol., ii, 146).—The potassium hydroxide solution, which forms the electrolyte in the iron-nickel peroxide accumulator, becomes more concentrated during discharge and vice versa. The change of concentration is almost complete as soon as the charge or discharge is ended; in both cases, the large change is followed by a small gradual increase of concentration, due to decomposition of water by the finely-divided iron of the cathode. The change is therefore due to combination of water with the nickel peroxide electrode during discharge; the quantity taken up is between 1 and 2 molecules for each faraday given out by the cell. The *E.M.F.* of the cell decreases as the concentration of the electrolyte increases; the change is very small (2·8 millivolts when the concentration increases from 2·8*N* to 5·3*N*, for example). A calculation of the change to be expected, based on the vapour pressures of the solutions, gives values of the same order of magnitude as those observed. T. E.

Explanation of Supertension. II. Felix Kaufler (*Zeitsch. Elektrochem.*, 1908, 14, 321—326. Compare Abstr., 1907, ii, 924).—The resistance of an electrolytic cell with lead electrodes and sulphuric acid of maximum conductivity as electrolyte is measured during the passage of a current. In these circumstances, there is a "supertension" at the cathode, that is, the apparent fall of potential between cathode and electrolyte is greater than that corresponding with the reversible decomposition of water into oxygen and hydrogen at atmospheric pressure. The addition of a trace of copper sulphate removes this supertension. It is found that the resistance of the cell with copper sulphate is the same as that calculated from the resistance of the sulphuric acid and the dimensions of the cell, but when "supertension" exists it is greater. There is therefore a high resistance film at the surface of the cathode; possibly this is a hydride of lead, the rate of decomposition of which is much accelerated by traces of platinum or copper.

Further experiments are made in the same way as before with a platinised platinum cathode (or anode), which is heated to a higher temperature than the electrolyte by means of a current of electricity. Here there is practically no supertension, and yet reactions (reduction of benzophenone; oxidation of *p*-nitrotoluene) take place at it which usually are observed only at electrodes showing supertension. The author believes that supertension is not the cause, but a symptom, of a reaction. When a finite current is flowing, the electrolytic changes are always irreversible, and the electrode potential, therefore, higher than that corresponding with the main reaction. Traces of substances of higher potential may therefore be formed, and these condition the potential of the electrode. T. E.

Transport Number for Dilute Hydrochloric Acid. KARL DRUCKER and B. KRŠNJAVI (*Zeitsch. physikal. Chem.*, 1908, 62, 731—742. Compare Jahn, Abstr., 1901, ii, 540; Noyes and Sammet, Abstr., 1903, ii, 126; Noyes and Kato, this vol., ii, 346).—The authors have made a very careful determination of the transport number for chlorine in a solution of hydrochloric acid, special attention being directed to the purity of the materials used and to the accuracy of the analyses. The apparatus employed was essentially that due to Loeb and Nernst, the bulk of solution being large enough to permit the analysis of five sections of the conducting column in addition to the solutions round the electrodes. These were both made of palladium, the anode being charged with hydrogen.

For the transport number of chlorine at 18°, the authors deduce the value 0·1697 from analysis of the anode solution, and 0·1647 from analysis of the cathode solution. The cause of the divergence of these numbers cannot be traced.

Discussion of their own and others' results leads the authors to the conclusion that the transport number for chlorine in highly diluted hydrochloric acid is at least 0·170 at 18°, and that the ionic conductivity of hydrogen at the same temperature is not more than 313. J. C. P.

Electrochemical Equivalents of Oxygen and Hydrogen. ROBERT A. LEHFELDT (*Phil. Mag.*, 1908, [vi], 15, 614—627).—A form of electrolytic gas voltameter is described wherein the gas is measured by displacement of mercury, which is weighed. The errors of the measurements of electricity, time, volume of gas, pressure, and temperature are fully discussed; the results are probably correct to less than 1 part in 1000. Solutions of sulphuric acid, sodium hydroxide, sodium sulphate, sodium thiosulphate, disodium hydrogen phosphate, sodium chromate, potassium iodide, potassium dichromate, sodium oxalate, sodium arsenate, sodium nitrate, and sodium chlorate were tried. Of these, sodium sulphate and potassium dichromate give correct results, but the other substances give too little gas; even with sodium hydroxide the quantity of gas obtained varied from 98·5% to 99·8% of the theoretical quantity. The mean of sixteen experiments with sodium sulphate and potassium dichromate was 0·17394 c.c. of gas (under normal conditions) per coulomb, from which it follows that the quantity of electricity required to decompose an equivalent of water (1 faraday) is 96590 coulombs. T. E.

Amphoteric Electrolytes. Bror Holmberg (*Zeitsch. physikal. Chem.*, 1908, **62**, 726—730. Compare Bredig, *Zeitsch. Elektrochem.*, 1899, **6**, 34; 1904, **10**, 245; Walker, Abstr., 1904, ii, 309; 1905, ii, 138; 1906, ii, 735; Lundén, Abstr., 1906, ii, 265, 828; Johnston, Abstr., 1906, ii, 733; Cumming, Abstr., 1906, ii, 734).—The hydrogen ion concentration in solutions of various amphoteric electrolytes (*o*-, *m*-, and *p*-aminobenzoic acids, *d*-aspartic acid, and *d*-glutamic acid) has been determined by the ethyl diazoacetate catalysis (see Bredig and Fraenkel, Abstr., 1905, ii, 692; Fraenkel, Abstr., 1907, ii, 746). The values so found are in good agreement with the calculated values.

J. C. P.

Electrolytic Valve Action of Zinc, Cadmium, Silver, and Copper. Günther Schulze (*Ann. Physik.*, 1908, [iv], **26**, 372—392. Compare Abstr., 1907, ii, 842; this vol., ii, 350).—Zinc and cadmium exhibit electrolytic valve action in a solution of potassium carbonate. The normal effect is not obtained in the case of zinc for solutions containing less than 10% of carbonate; at this concentration the maximum voltage is 83*V*. Cadmium shows the normal valve action in a 1% solution, the maximum voltage for this concentration being 126*V*. For both metals the maximum voltage decreases rapidly with increasing concentration of the electrolyte. For a given concentration the maximum voltage is much higher for zinc than for cadmium, and this voltage is reached at a much smaller current density in the case of zinc. The diminution of the maximum voltage with rise of temperature is much less rapid for zinc than for cadmium.

Electrolytic valve action is also exhibited by silver in solutions of hydrochloric, hydrobromic, and hydriodic acids, and by copper in a solution of hydrofluoric acid. In these cases the phenomenon appears to be due directly to the formation of a layer of solid on the surface of the anode.

Summarising the results obtained with different metals, the author points out that the faculty of a metal to give rise to electrolytic valve action depends on the particular group of the periodic system to which the metal in question belongs. H. M. D.

Influence of the Silent Discharge on Explosive Gaseous Mixtures. HEINRICH FASSBENDER (*Zeitsch. physikal. Chem.*, 1908, **62**, 743—759).—When a mixture of carbon monoxide and oxygen is exposed to the silent discharge, the rate of explosion is increased. This result, however, is shown to be due to the presence of ozone produced by the discharge. In this connexion, it is noteworthy that when a mixture of carbon monoxide and oxygen is exploded, a piece of potassium iodide-starch paper exposed to the gases is turned blue by the ozone formed in the explosion.

The velocity of explosion of a dry mixture of hydrogen and chlorine is not increased by previous exposure of the mixture in an alternating field. The author's experiments show, however, that during such an exposure the slow combination of hydrogen and chlorine is accelerated. A similar slow combination of carbon monoxide and oxygen is promoted by the influence of an alternating field, but in this case the field must be much more powerful in order to produce the result.

From these experiments it appears that in an explosive gaseous mixture, ionisation and dissociation result from the action of an alternating field, but that this state of dissociation does not persist, the dissociation products combining forthwith to form new neutral molecules. Such a formation of dissociation products and their subsequent combination under the influence of the silent discharge is sometimes so vigorous as to lead to the ignition of the gaseous mixture. This phenomenon was observed especially with mixtures of carbon monoxide and oxygen, a case in which the heat of combination is very great. J. C. P.

Is the Fixation of Atmospheric Nitrogen in the Electric Discharge to be Regarded as a Purely Thermal Effect? G. BRION (*Zeitsch. Elektrochem.*, 1908, **14**, 245—251).—The electric discharge through a gas is carried by a comparatively small number of ions, which have a very much larger kinetic energy than the majority of the molecules. The distribution of energy in the gas is therefore quite different from that in a gas of the same average temperature through which no discharge is passing. The application of the ordinary laws of chemical equilibrium does not, therefore, appear to be justified. The yields of nitric oxide actually obtained in practice are explicable on the assumption of an "electrical" temperature of about 4000° for the molecules which carry the current, but, on the other hand, the small yields obtained with small currents in the glow discharge are not in harmony with this view. T. E.

Difference of Potential and the Stability of the Alternating Arc between Metals. CHARLES E. GUYE and A. BRON (*Compt. rend.*, 1908, **146**, 1090—1093).—The authors find that the difference of potential measured depends within wide limits on the degree of stability of the arc, so that any cause (gas pressure, cooling, air currents, diminution in the self-induction, or the resistance of the circuit, &c.) which tends to diminish this stability, that is, to prolong the duration of the extinction, immediately results in an increase of the efficacious difference of potential at the electrodes. Similar lack of stability, by producing momentary extinctions, will vitiate experiments with the continuous current arc. By the disposal of a very large reserve tension in the open circuit (20,000 volts) and heating the electrodes almost to their melting point, arcs are obtained of extreme stability. Under these conditions, the extinction period becomes negligible, and the experimental results can be easily interpreted conformably with the views on the mechanism of the arc. The authors show that, other conditions being equal, the potential difference tends towards an inferior limit which is approximately the same for all metals, provided they are only slightly volatile. As the result of experiments in air at 40 cm. pressure for a distance between the electrodes of 4 mm. and an alternating intensity of 0·1 ampere (frequency 50), the limit for platinum, gold, palladium, silver, copper, nickel, iron, and aluminium is found to be approximately 475 volts. For volatile metals the limit is lower.

In the case of long arcs of small intensity between non-volatile metals, the medium between the electrodes (the latter must be incandescent in order to emit the electrons required to maintain the arc), which is ionised by the electrons and which is principally concerned in the difference of potential, is almost wholly air in every case. This accounts for the fact that the potential difference is independent of the nature of the metal. When the ionised medium contains metallic vapours, as in the case of short intense arcs, or with volatile electrode metals, this independence, of course, no longer is observed.

The minimum potential difference obtained as the gas pressure diminishes, already observed with short intense arcs, is also found with the arcs here experimented with. The gas pressure corresponding with this minimum is 5—7 cm.

Thus it seems that below a certain pressure the number of gaseous molecules interposed between the electrodes is insufficient for the normal ionisation, an increase in the potential difference then becoming necessary in order to maintain the same current.

Under the conditions of extreme stability, the law of the decrease of the potential with the pressure is a linear one. E. H.

Theory of Dulong and Petit's Law. I. Franz Richarz (*Zeitsch. anorg. Chem.*, 1908, **58**, 356—374).—A theoretical paper, which contains a summary of the author's work on this subject published at intervals during the last fifteen years (compare Abstr., 1893, ii, 404). A simple proof is given of the well-known result that the atomic heat of a gas at constant volume is 3. Further, on certain assumptions, based mainly on atomic considerations, it is shown that the atomic heat of solid elements at constant volume is constant and equal to 6·012. The atomic heat at constant pressure is greater, owing to the work done in overcoming the attraction of the atoms, and varies from 6·072 to 6·914 for different elements. The theory also accounts satisfactorily for the fact that some elements have exceptionally low atomic heats (compare Behn, Abstr., 1900, ii, 259).

G. S.

Thermal Expansion and Specific Heat of Metals. E. Grüneisen (*Ann. Physik.*, 1908, [iv], **26**, 211—216).—From a comparison of the true coefficients of expansion and the true specific heats of aluminium, iron, nickel, copper, palladium, silver, iridium, and platinum within wide limits of temperature, it is shown that the quotient of the coefficient of expansion by the specific heat is almost independent of the temperature. Except in the case of iridium and platinum, for which the values of the quotient are very nearly constant, the ratio of the two numbers appears to increase slightly with the temperature. For those intervals of temperature in which molecular changes take place, the relationship does not hold. The author supposes that the variations of the expansion and the specific heat with temperature are due to the operation of the same cause, and reference is made to the hypothesis of Richarz relating to the influence of temperature on specific heat. H. M. D.

Relationship between Compressibilities, Thermal Expansions, Atomic Volumes, and Atomic Heats of the Metals. E. Grüneisen (*Ann. Physik.*, 1908, [iv], **26**, 393—402).—The fact that the compressibility of the elements exhibits periodicity has led the author to inquire into the relationship between this and other physical properties for which a similar periodicity has been established. Denoting the compressibility by K, the thermal expansion by $3a$, the volume of a gram atom by v, and the atomic heat at constant pressure by C_p, and applying the kinetic theory to the metals which are supposed to be monatomic in the solid state, it is shown that $3av/K$ and $3av/KC_p$ should be constant. For twenty metals, the values of these expressions are shown to be in fairly close agreement; antimony and bismuth show the largest deviations from the mean value. The assumption that the solid metals and liquid mercury are monatomic is in consequence considered to be justified. The relationships involved may be used for the deduction of the compressibilities of metals which have not been subjected to direct measurement. For silicon and liquid chlorine, the expression $3av/K$ is found to have the same value as it has for metals. H. M. D.

Change of Density and Specific Heat of Platinum and Nickel after Treatment, and the Dependence of the Specific Heat on the Temperature. Wilhelm Schlett (*Ann. Physik.*, 1908, [iv], **26**, 201—210).—The changes which take place in the density and specific heat of platinum and nickel after various kinds of mechanical treatment, such as hammering, rolling, and cold-drawing, and also after heating to a high temperature, have been examined. In both cases the more dense form of the metal has the smaller specific heat, a relationship already pointed out for the allotropic modifications of the non-metals. From a comparison of the variations of the specific heat with the temperature and with the density, the conclusion is drawn that a rise of temperature causes molecular changes to take place which are very different from those brought about by mechanical treatment.

The true specific heat of nickel between 0° and 300° is given by

$C_t = 0{\cdot}10280 + 0{\cdot}0000941t$, and that of platinum by $C_t = 0{\cdot}030456 + 0{\cdot}00002972t + 0{\cdot}0000000561t^2$.
H. M. D.

Practice of Cryometric Measurements. PODA (*Zeitsch. angew. Chem.*, 1908, **21**, 1066—1069).—A freezing-point apparatus is described by means of which accurate determinations can be carried out rapidly. The vessel in which the liquid is contained consists of a double-walled tube expanded to form a bulb in the lower half; by means of a tube sealed on to the bulb, the space between the two walls communicates with a levelling tube through a piece of thick-walled rubber tubing. By raising or lowering the levelling tube, the space between the walls of the freezing vessel can be filled with mercury or exhausted; by this means ice which has separated out from an aqueous solution can be quickly melted, or during a measurement the loss of heat by radiation can be reduced to a small value. A simple form of stirrer is also described, and numbers are recorded for the freezing points of sucrose and potassium chloride solutions.
H. M. D.

Stand for Apparatus for Cryoscopic Measurements. ROBERT LESPIEAU (*Bull. Soc. chim.*, 1908, [iv], **3**, 613—617).—A stand is described provided with (1) a small platform on which the refrigerator vessel and its contents can be placed, (2) a driving-wheel by which the thermometer suitably provided with a pulley can be caused to rotate in the solution under examination, and (3) a support in which the thermometer rotates. The stand is figured in the original.
T. A. H.

Calculation of Thermochemical Constants. H. STANLEY REDGROVE (*Chem. News*, 1908, **97**, 253—255, 266—268. Compare Abstr., 1907, ii, 604; this vol., ii, 463).—The molecular heats of combustion and molecular heats of formation of eight ethers, nine primary, one secondary, and two tertiary alcohols, three aldehydes, two ketones, nine esters, three organic acids, and one organic anhydride have been calculated by means of the author's system of "fundamental constants." For thirty-four substances out of the thirty-eight up to the present considered, the results are in excellent agreement with those values actually found by Thompsen. A table of the "Fundamental Molecular Heat of Combustion and Formation, Oxygen Constants" is also given.
J. V. E.

New Method for Determining Vapour Densities. III. PHILIP BLACKMAN (*Ber.*, 1908, **41**, 1588—1591; 2487—2488. Compare Abstr., 1907, ii, 931; this vol., ii, 157).—A small error in the author's method of determining vapour densites, caused by air bubbles trapped in the mercury column, is overcome by heating the mercury and re-reading the gas volume after the temperature has again reached that of the laboratory. Details are quoted of vapour density determinations with a number of substances to illustrate the accuracy of the method.
G. Y.

Application of a Deduction from the Boyle-Mariotte Law. H. REBENSTORFF (*Chem. Zeit.*, 1908, 32, 570).—From the equation for isothermal alteration of a closed volume of a gas, the expression $\Delta v/v' = \Delta p/p$, as also $\Delta v/v = \Delta p/p'$, has been arrived at; this is called the "*alteration law*," and states that the alteration of volume is to the one volume as the alteration of pressure is to the other pressure. Use is made of this relationship for finding the volume of large air vessels in a rapid and convenient manner. The vessel the capacity of which is to be measured is connected by a rubber tube carrying a pinch clip to a graduated glass tube filled with water, and covered at its lower end with a piece of fine muslin. On opening the pinch clip, water flows out of the tube, giving a measure on the scale of the alteration of volume Δv of the unknown volume v, and at the same time a measure of the decrease of pressure Δp from the original atmospheric pressure p'. From this, the unknown volume of the vessel may be calculated from the equation above. By lowering a weighted bottle, the mouth of which is covered by muslin, into water and measuring the water that has been forced into the bottle by the increased pressure, an approximate estimation of the depth of the water may be obtained. J. V. E.

Molecular Aggregations Produced in Gases by Sudden Cooling. GWILYM OWEN and A. Ll. HUGHES (*Phil. Mag.*, 1908, [vi], 15, 746—761. Compare Abstr., 1907, ii, 843).—The previous experiments on the production of condensation nuclei by cooling gases to low temperatures have been extended. It is now found that the effect depends to a large extent on the rapidity of the cooling process. By cooling rapidly, condensation nuclei are formed in air at temperatures considerably higher than the maximum temperature in the case of slow cooling. At a given temperature below this maximum, the number of nuclei produced is much greater when the air is cooled very quickly than when slow cooling takes place. The so-called "nucleating temperature" also varies with the size of the apparatus into which the gas to be cooled is admitted, but this phenomenon is supposed to be simply due to a difference in the rate of cooling which is attainable when cooling vessels of different sizes are employed.

Carbon dioxide can be cooled to its condensation temperature without nuclei being produced; when the condensed solid sublimes, large nuclei are, however, formed. Ethylene does not show a "nucleating temperature," but with methane results are obtained similar to those met with in the case of air. The phenomena in mixtures of these gases can be accounted for when the partial pressures of the components are taken into consideration.

Experiments made to determine the influence of temperature on the persistency of the nuclei show that rise of temperature increases the rate of disappearance. The nuclei are not electrically charged.

H. M. D.

Osmotic Pressure. ISIDOR TRAUBE (*Pflüger's Archiv*, 1908, 123, 419—432).—The direction of osmosis is determined by the difference of surface tension towards air of the liquids separated by the membrane. This difference is termed the "surface pressure," and is regarded, instead of the osmotic pressure, as the directing force governing osmosis. The membrane also plays some part in the process, for, according to Willard Gibbs, substances which lower the surface tension of a solvent have a tendency to collect on the surface. The dissolved substance also has an influence on the solvent, exerting what is termed a cohesion pressure; the more a substance lowers the surface tension of a solvent the smaller is this cohesion pressure.

The smaller the cohesion pressure exerted by a substance the more readily will it tend to be eliminated from the solution, and the more readily will it be dissolved or adsorbed by a second liquid or solid phase in contact with the solution.

A simple relationship can be deduced between the lowering of surface tension, adsorption, and the coefficient distribution of a substance between two solvents.

In the above theory, the cohesion pressure of a substance in the separating membrane will also exert influence on the rate and direction of diosmosis.

This theory, too, which takes into account the cohesion pressure, is capable of explaining facts which are not explicable by Overton's theory of the distribution of substances between lipoids and non-lipoids, as, for example, the absorption of peptones which are not readily soluble in lipoids.

It has been applied to explain this, and other absorption phenomena in the digestive tract, and also the action of the kidneys, where it can be shown that there is an intimate relationship between the functional capacity and the surface tension of the urine. The theory has also been applied to explain the action of lymphagogues and certain phenomena of parthogenesis, also hæmolysis, narcosis of the ganglia, plasmolysis, &c. S. B. S.

Relation between the Diffusion Constant, Internal Friction, and Electrical Conductivity. LEO PISSARJEWSKY and E. KARP (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 599—611*).—After discussing the work of Jones and Lindsay (Abstr., 1903, ii, 55), Jones and Carroll (Abstr., 1905, ii, 73), Pissarjewsky and Lemcke (Abstr., 1905, ii, 684), and Walden (Abstr., 1906, ii, 335), the authors give the results of their own determinations of the diffusion constant, internal friction, and electrical conductivity of solutions of sucrose, sodium chloride, sodium hydroxide, ammonia, and acetic acid in water or aqueous alcohol.

When the diffusing substance is a non-electrolyte, such as sucrose, the product of the diffusion constant and the internal friction, $D.\eta$, is a constant, and for acetic acid this product also remains comparatively constant.

In the case of electrolytes, the values of $D.\eta$ vary as much as 30%. If this variation depends on differences in the degree of dissociation, the value of $D.\eta/a$ should exhibit greater constancy than $D.\eta$. It is first shown that $D\eta/a = D\mu_v/\mu'_v$, where μ_v and μ'_v are the molecular conductivities of the substance in water and the given solvent respectively, and then found by conductivity measurements of aqueous and aqueous alcoholic N-sodium chloride and of $4/7N$ solutions of sodium chloride in water and sucrose solutions that $D\mu_v/\mu'_v$ is constant.

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* and *Zeitsch. physikal. Chem.*, 1908, **63**, 257—268.

It also seems probable that for all electrolytes in all solvents, $D\eta\sqrt{M}/\alpha$ is constant. When D and η are given, this relation renders it possible to calculate α, and then, having determined μ_v and η_v, to calculate μ_∞ for the given electrolyte in the given solvent according to the formula $\alpha = \mu_v \cdot \eta_v / \mu_\infty \cdot \eta_\infty$.

When the dilution is such that α has the value unity, the above relations become $D\eta = \text{constant}$ and $D\eta\sqrt{M} = \text{constant}$, and as, also, $\mu_\infty \eta$ is constant, we have $D/D' = \mu_\infty / \mu'_\infty$, that is, the ratio of the diffusion constant of any given electrolyte to its molecular conductivity at infinite dilution is constant for different solvents. T. H. P.

Time Taken by Substances in Dissolving. GASTON GAILLARD (*Compt. rend.*, 1908, **146**, 1020—1022. Compare Abstr., 1905, ii, 241).—In the experiments described, given weights of various substances (sodium thiosulphate, sodium sulphate, sucrose) were introduced into fixed quantities of solvent at a known temperature and agitated by a turbine-driven stirrer regulated to a constant known velocity, and the time elapsing between the addition and the total disappearance of the substance observed. Only the results of experiments in which portions of the same sample of substance and the same rate of stirring were employed can be compared, since the size of the crystals and the rapidity of diffusion have considerable influence on the time of dissolution. The following results are obtained: (1) With increasing quantities of the same substance, the ratio of the time to the concentration obtained is (within the limits of the experiments) at first practically constant, and then increases. (2) In certain cases the curve, obtained by plotting reciprocals of the times against the corresponding temperatures, is comparable with the solubility curve. But salts of equal solubility may take widely different times to dissolve, and the variation of the time with the temperature does not always follow that of the solubility. (3) For some mixtures of salts (potassium chromate and sulphate, ammonium and potassium nitrates, sodium chloride and potassium nitrate) the variation in the time is in the same sense as the modification in the solubility, but these variations are small. (4) A table is given showing the increase in the times required for the dissolution of successive equal quantities of sodium chloride or sucrose in the same quantity of solvent, each addition being made immediately after the disappearance of the preceding quantity of substance. E. H.

Influence of Temperature on Complex Formation in Solution. ALFRED BENRATH (*Zeitsch. anorg. Chem.*, 1908, **58**, 257—264. Compare Abstr., 1907, ii, 694).—From the results of ebullioscopic, and in some cases of cryoscopic, determinations with mixtures of two salts in water and in alcohol as solvents, it is shown that when there are deviations from additive behaviour, they are greater at the freezing point than at the boiling point. This is best accounted for on the view that complexes of the two salts partly decompose as the temperature is raised.

Cobalt and cupric chlorides do not appear to combine with sodium chloride in aqueous solution at 100° even when the concentration of the latter salt is high, but in alcoholic solution the elevation of the boiling point for mixtures of lithium chloride with cobalt and cupric chlorides respectively is smaller than the sum of the effects due to the salts separately. Mixtures of nitrates which give an abnormally small freezing-point depression behave normally at the boiling point. Cadmium chloride does not combine appreciably with sodium chloride at the boiling point of the aqueous solution. Experiments have also been made with mixtures of mercuric chloride and potassium and sodium chlorides respectively. G. S.

Influences of Solubility. GIUSEPPE KERNOT, E. D'AGOSTINO, and M. PELLEGRINO (*Gazzetta*, 1908, **38**, i, 532—554).—The authors have studied the influence of increasing proportions of (1) potassium chloride on the solubility of calcium hydroxide, (2) ammonium chloride on the solubility of barium carbonate, and vice versa. The results, which are given in the form of both tables and curves, are briefly as follows.

In presence of increasing quantities of potassium chloride, the solubility of calcium hydroxide at first increases and afterwards diminishes, becoming less than the solubility in water alone (compare Rothmund, Abstr., 1900, ii, 467; Rothmund and Wilsmore, Abstr., 1902, ii, 447; Hoffmann and Langbeck, Abstr., 1905, ii, 374).

The solubility of barium carbonate rises continuously as the amount of ammonium chloride present increases, and at 25°, when the solution contains about 5 mols. of the chloride, the solubility curve assumes an upward inflexion, which is probably due to the formation of a double chloride of barium and ammonium. The relation of the solubility of ammonium chloride to the proportion of barium carbonate present is represented by a curve perfectly analogous to the preceding one.

Conductivity curves indicate that the degree of dissociation of potassium chloride is not altered by the presence of calcium hydroxide, or that of ammonium chloride by the presence of barium carbonate. The conductivity of the mixed solution may be regarded as the sum of the conductivity of the saturated solution of the substance influenced and that of the solution of the influencing substance, so that the amount of the substance influenced which is brought into solution or expelled therefrom by the influencing substance does not participate in the formation or destruction of the electric molecules.

In order to obviate difficulties in the analysis of the mixed solutions, the authors have made use of the following method, which reduces all the determinations to simple weighings. The two substances are weighed, one after the other, into the same vessel, which is placed in a thermostat in which it can be rotated. Water is then gradually added to the vessel, avoiding contact with the air, until the two substances are completely dissolved. This may be effected conveniently by means of two flasks, one inverted above the other, the two being connected by means of a glass tube passing through rubber stoppers in the two flasks and having its lower end drawn out to a fine point. The upper flask is filled to the extent of about 19/20 with water, which may be forced into the lower flask in quantities as small as desired by gently warming the air in the upper flask.

T. H. P.

Solubilities in Mixed Solvents. Walter Herz and F. Kuhn (*Zeitsch. anorg. Chem.*, 1908, **58**, 159—167. Compare Abstr., 1904, ii, 709; 1905, ii, 510, 709; 1907, ii, 159, 848).—The solubility of mercuric chloride, bromide, iodide, and cyanide in mixtures of methyl and ethyl alcohol in varying proportions has been determined at 25°, and the density and viscosity of the solutions have also been determined.

For the bromide, iodide, and cyanide, $L-l$ (L = observed solubility, l = solubility calculated on the assumption that the components exert their effect independently) is small, and may be positive or negative. The solubilities and densities increase, and the viscosities decrease, throughout as the proportion of methyl alcohol increases. For mercuric chloride, $L-l$ is fairly large for intermediate concentrations, and is positive throughout; the different behaviour in this case is probably to be ascribed to the fact that the salt combines with methyl alcohol (McIntosh, Abstr., 1897, ii, 372). For the chloride, bromide, and cyanide, $L-l$ attains its maximum value for the mixture containing the components in equivalent proportions. G. S.

[Vapour Pressure of Dry and of Ordinary Sal Ammoniac.] Johannes J. van Laar (*Zeitsch. physikal. Chem.*, 1908, **62**, 678—680. Compare this vol., ii, 353).—A further criticism of Abegg's views (this vol., ii, 157, 466). J. C. P.

Thermodynamics of the Sulphuryl Chloride Equilibrium $SO_2 + Cl_2 \rightleftharpoons SO_2Cl_2$. Max Trautz, E. Baisch, and Alfred von Dechend (*Zeitsch. Elektrochem.*, 1908, **14**, 271—280).—In order to calculate the equilibrium between sulphuryl chloride, sulphur dioxide, and chlorine, it is necessary to know the vapour-pressure curve of sulphuryl chloride, its heat of evaporation, and the specific heat of the vapour. Details of the methods used in determining these quantities are given. The results obtained are: vapour pressure (in mm. of mercury) at −78°, 0·2; 0°, 40·92; 17·99°, 95·2; 34·73°, 209·6; 40·13°, 263·9; 45·26°, 322·1; 50·42°, 292·1; 55·25°, 467·8; 60·09°, 555·9; 64·94°, 656·2; 69·62°, 766·9. Many other points on the curve were determined. The heat of evaporation (per molecule) at pressure p and absolute temperature T is given by $\lambda = (1 - p/55)(8940 + 3{\cdot}5T - 0{\cdot}02845T^2)$. The molecular heat of the vapour at 43 mm. pressure between 16° and 99° is 15·5. T. E.

Equilibrium Between Metals and Solutions of Metallic Salts. Emil Bose (*Zeitsch. Elektrochem.*, 1908, **14**, 314—316).—By means of the apparatus already used for silver and gold (Abstr., 1907, ii, 735; this vol., ii, 264), it is now shown that platinum is more soluble in a hot concentrated solution of platinum tetrachloride than in a cold one. The difference is very small, and prolonged circulation is required in order to obtain a precipitate of platinum in the cold tube. The equilibrium is $Pt + Pt^{\cdot\cdot\cdot\cdot} \rightleftharpoons 2Pt^{\cdot\cdot}$. A bibliography of investigations dealing with equilibria of this kind is given. T. E.

Influence of the Solvent on the Equilibrium Constant. Leo Pissarjewsky and A. Levites (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 611—623).—The influence of the solvent on the equilibrium constant is often very considerable. Thus, *K* of the reaction $CaSO_4 + 2OH' \rightleftharpoons SO_4'' + Ca(OH)_2$ in 10·5% aqueous mannitol solution is eleven times, and in 23·7% aqueous glycerol solution nineteen times, as small as in water, whilst *K* of the reaction $Ag^{\cdot} + Fe^{\cdot\cdot} \rightleftharpoons Fe^{\cdot\cdot\cdot} +$ (Ag) in 10·5% mannitol solution is about sixteen times as small as in water. Comparison of the changes of free energy in the reaction $CaSO_4 + 2OH' \rightleftharpoons SO_4'' + Ca(OH)_2$ in water and in equal molecular aqueous solutions of methyl and ethyl alcohols, ethylene glycol, glycerol, and erythritol leads to the empirical relation $A = A_b - 100B.\eta$, where A and A_b are the changes of free energy in the alcoholic solution and water respectively, B the number of hydroxyl groups in the alcohol employed, and η the relative internal friction of the alcoholic solution. In all cases where the degrees of dissociation of the reacting substances in the various solvents are identical, it seems probable that the product $A\eta$ is a constant. By the gradual addition of glycerol to water, the change of the free energy of the reaction $CaSO_4 + 2OH' \rightleftharpoons SO_4'' + Ca(OH)_2$ diminishes in such a manner that the product of the free energy into the number of mols. of added glycerol is constant. The marked influence of the solvent on the equilibrium constant may also be applied to the determination of the change of free energy of non-reversible reactions. T. H. P.

Transition Concentrations. I. Conversion of Lanthanum Oxalate into Sulphate by Sulphuric Acid. F. Wirth (*Zeitsch. anorg. Chem.*, 1908, **58**, 213—227).—The equilibrium in the condensed system lanthanum oxalate and sulphate and the free acids has been investigated in the usual way by solubility measurements at 25°, and the relations are discussed on the basis of the phase rule.

The solubility of oxalic acid in water diminishes on progressive addition of sulphuric acid, at first rapidly, and then, beyond 12% of acid, comparatively slowly. The solubility of lanthanum oxalate in water increases with the concentration of sulphuric acid up to 1·9 mols. of the latter in 1000 grams of solution, at which point the solution contains 0·0264 mol. of lanthanum oxide in 1000 grams. As the concentration of sulphuric acid is further increased, the lanthanum oxalate is gradually converted into sulphate along the "transition curve," the proportion of lanthanum oxide in solution at the same time steadily decreasing. The transition curve oxalate —> sulphate meets the two solubility curves of lanthanum oxalate and sulphate respectively in sulphuric acid in the presence of solid oxalic acid at a triple point at which the solution is in equilibrium with the three solid phases. At this point, the solution contains about 2·5 mols. of sulphuric acid and 0·011 mol. of lanthanum oxide in 1000 grams. The solid salts in equilibrium with the solution at the triple point are $La_2(C_2O_4)_3,7H_2O$ and $La_2(SO_4)_3,9H_2O$. G. S.

Equilibria in Quaternary Systems. FRANZ A. H. SCHREINEMAKERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **10**, 817—823).—The equilibria in certain quaternary systems have been investigated by solubility measurements in the usual way, and the results are represented on projected space diagrams.

The systems water, methyl and ethyl alcohols and ammonium nitrate; water, methyl and ethyl alcohols and potassium nitrate, and water, ethyl alcohol, ammonium and silver nitrates, have been investigated at 30°. The latter system is the most complicated, as a double salt, $NH_4NO_3,AgNO_3$, exists, which is soluble without decomposition in water and in 71% alcohol, but is decomposed by 91% alcohol. Equilibria similar to the last named occur at 30° in the systems water, ethyl alcohol, silver nitrate and potassium nitrate, and water, alcohol, benzoic acid and ammonium benzoate; in the latter case, a double compound of benzoic acid and ammonium benzoate is formed.

The equilibria in the system water, ethyl alcohol, ammonium and manganese sulphates are very different at 50° and 25°; at the former temperature, an anhydrous double salt, $2(MnSO_4)_2,(NH_4)_2SO_4$, and the hydrate, $MnSO_4,H_2O$, are stable, and at the latter temperature the compound $MnSO_4,(NH_4)_2SO_4,6H_2O$. G. S.

Reactions in Solutions of Different Salts, but with the Same Ions. ALBERT J. J. VANDEVELDE (*Chem. Zentr.*, 1908, i, 1360; from *Rev. gén. Chimie*, 1908, **11**, 57—59).—It has been shown previously (Abstr., 1907, ii, 609) that the velocity of reaction is not influenced by the substitution of copper for zinc in copper sulphate solution, but depends on the nature of the ions present; Cl ions increase and SO_4-ions retard the reaction. The production of the copper solution is effected equally well from $CuSO_4 + NaCl$ or $CuCl_2 + Na_2SO_4$; the same applies to acid solutions, for example, $H_2SO_4 + 2NaCl$ and $2HCl + Na_2SO_4$, &c. J. V. E.

Estimation of the Concentration of Hydrogen Ions by Indicators. LEONOR MICHAELIS and PETER RONA (*Zeitsch. Elektrochem.*, 1908, **14**, 251—253).—A simple way of estimating the concentration of the hydrogen ions in a solution (between 0·0005 and 0·01*N*) is to add Congo-red to the solution, and compare this colorimetrically with a solution containing a known quantity of hydrochloric acid. The authors find, however, that the colour is changed by neutral salts, the acidity apparently decreasing. Salts of the alkali metals have the same effect, those of bivalent metals a greater effect, and those of tervalent metals a still greater one. Measurements of the *E.M.F.* of concentration cells with hydrogen electrodes show that no change occurs in the concentration of the hydrogen ions. The change of colour is the first stage in the precipitation of the colouring matter, and is analogous to the change of colour of a colloidal solution of gold which precedes coagulation. Methyl-violet behaves in a similar way, the change of colour being, however, in the opposite direction. Phenolphthalein and methyl-orange also exhibit colour changes when very large quantities of neutral salts are used.

T. E.

Kinetics of the Sulphonation Reaction. HAAVARD MARTINSEN (*Zeitsch. physikal. Chem.*, 1908, **62**, 713—725. Compare Abstr., 1905, ii, 149; 1907, ii, 609).—The author has studied the rate at which *p*-nitrotoluene undergoes sulphonation when dissolved in sulphuric acid. The possibility of following the course of the reaction depends on the fact that *p*-nitrotoluene is nitrated with great rapidity by nitric acid, whereas this reagent has no appreciable effect on *p*-nitrotoluenesulphonic acid. A determination therefore of the quantity of nitric acid used up by a given volume of the reaction mixture serves to indicate the extent to which sulphonation has proceeded at any selected time. As in the earlier work (*loc. cit.*), the nitrometer was employed in the determination of unused nitric acid.

One of the reagents, namely, the sulphuric acid, was always present in large excess, and it was therefore expected that sulphonation would proceed according to the formula for a unimolecular reaction. This is borne out generally by the experimental results, which, however, bear evidence also to the marked influence of traces of water, even the small amount produced in the reaction leading to a decrease of the velocity-coefficient as time goes on. Three solvent media were used, namely: (1) absolute sulphuric acid containing 2·4% SO_3; (2) absolute sulphuric acid; (3) an acid containing 99·40% H_2SO_4 and 0·49% H_2SO_3. The values of the velocity-coefficient observed in these three media were respectively 0·003, 0·0004, and 0·0000005. The temperature-coefficient of the velocity is 2·0—2·5 for a rise of 10°.

J. C. P.

Catalysis. V. Catalysis of Imino-esters. WILLIAM MCCRACKEN (*Amer. Chem. J.*, 1908, **39**, 586—613. Compare Derby, this vol., i, 419).—Stieglitz (this vol., ii, 167, 168) has given an account of the catalysis of imino-esters, and has stated that the decomposition of their hydrochlorides takes place as follows:

$$NH_2Cl\text{:}CPh\cdot OMe + H_2O = Ph\cdot CO_2Me + NH_4Cl,$$

and that it proceeds most rapidly with the salts of those imino-esters which are the weakest bases.

An investigation of this decomposition has now been carried out with the object of ascertaining whether it is the salt or the free base which undergoes the change into ester and ammonia, and also of determining whether there is any general relation between the velocity of decomposition of the salts and the affinity constants of the bases. The velocity of reaction and the hydrolysis constants have been determined with the hydrochlorides of ethyl, *iso*butyl, and *iso*amyl iminobenzoates, ethyl imino-*p*-toluate, methyl imino-*o*-toluate, ethyl iminophenylacetate, ethyl imino-*m*-nitrobenzoate, ethyl imino-*m*-bromobenzoate, and ethyl imino-*β*-naphthoate.

The results show that the velocity of decomposition of these imino-esters by water is proportional to the concentration of the salt formed with the acid, that is, of the positive ester ions. The whole salt does not undergo decomposition, but only its positive ions. The presence of an excess of hydrochloric acid decreases the velocity of reaction by reducing the degree of ionisation of the imino-ester salt, thus diminishing the active mass of the positive ester ions, and simultaneously tends to increase the velocity by a "salt effect." The acceleration due to the "salt effect" is practically the same for the same excess of acid acting on the salts of two imino-esters, of which the velocities of decomposition are as 10 : 1. This fact confirms the view that the "salt effect" is not due to a primary action on the salt, but to an effect on the active mass of water involved in the reaction. With two exceptions, the velocity constants were found to decrease as the strength of the imino-esters as bases increased. E. G.

Artificial Peroxydiastases. JULES WOLFF (*Compt. rend.*, 1908, **146**, 1217—1220. Compare this vol., i, 490).—The oxidation of pyrogallol under the combined influence of hydrogen peroxide and a colloidal solution of iron ferrocyanide has been studied in detail. The colloidal ferrocyanide solution used contained 0·0023 mg. of iron per drop, and the hydrogen peroxide solution 7mg. of active oxygen per drop. The total volume of solution in each experiment was 40 c.c., and the amount of pyrogallol present was 1·2 grams.

With a constant quantity of hydrogen peroxide (eight drops) and increasing quantities of ferrocyanide, the yield of purpurogallin is proportional to the amount of peroxydiastase until the latter reaches ten drops, after which the amount of purpurogallin increases more and more slowly.

In the presence of a fixed amount of ferrocyanide, the quantity of purpurogallin formed rises regularly as the amount of hydrogen peroxide present increases to nine drops, after which the increase in yield becomes less and less.

In experiments in which twenty drops of ferrocyanide, solution and five drops of hydrogen peroxide solution were used, addition of 2·5 mg. and 5·0 mg. of sulphuric acid reduced the yield of purpurogallin 17% and 62% respectively, whilst 0·85 mg. of ferrous sulphate or 0·89 mg. of copper sulphate produced a 70% reduction, but 0·84 mg. of manganese sulphate had very little effect. A similar prejudicial action of ferrous sulphate has been observed by Stoecklin (*Thesis*, Geneva, 1907) in the case of the natural peroxydiastase.

Amongst salts, potassium dihydrogen phosphate has a markedly noxious effect.

The conclusion is drawn that this colloidal ferrocyanide acts in all its essential respects like a natural enzyme. E. H.

[Deduction of the Stoicheiometric Laws.] EMIL BAUR (*Zeitsch. physikal. Chem.*, 1908, **62**, 760—761).—A reply to de Vries (this vol., ii, 366). J. C. P.

Commensurability of Atomic Weights. GUSTAVE D. HINRICHS (*Compt. rend.*, 1908, **146**, 971—973).—In a previous paper (Abstr., 1907, ii, 945), it was assumed that a perpendicular from the origin of co-ordinates upon the graph of the equation of condition in a given determination of atomic weight was equal to the deviation of the atomic weight from the "absolute" (round number) value. This is now said to be true only if the values of the analytical excess "*e*" in the equations of condition are distributed about the origin conformably with the laws of probability. Otherwise, a more detailed discussion of the experimental errors is necessary in order to determine the deviation of an atomic weight from the round number.

The atomic weight of silver is calculated from the synthesis of silver nitrate to be $(108 - \frac{1}{8}) = 107{\cdot}875$. Hydrogen is calculated to be $16/(16 - \frac{1}{8}) = 1{\cdot}00787$, whilst chlorine is given as $(35{\cdot}5 - \frac{1}{3} \times \frac{1}{8}) = 35{\cdot}458$.

The author claims that his results lend support to the hypothesis of the unity of matter, but the differences between successive elements must be expressed in terms of a smaller unit than hitherto.

R. J. C.

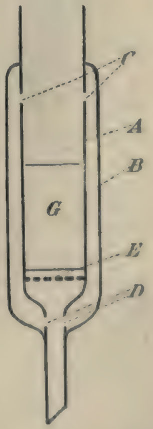
Atomic Weights of Sixteen Chemical Elements. Gustave D. Hinrichs (*Chem. Zentr.*, 1908, i, 1240; from *Mon. Sci.*, 1908, [iv], 22, i, 155—172).—From the published data, the author has calculated the atomic weights of the following elements by the method previously suggested (Abstr., 1893, ii, 317): bismuth, lead, mercury, iron, tellurium, potassium, bromine, iodine, manganese, cadmium, cobalt, indium, platinum, didymium, terbium, and radium. The difference of the calculated atomic weights from whole numbers is found to be decreased and often is due to experimental error. The probability of these values being whole numbers is raised to 10^{148} : 1 for the 28 elements up to the present considered. J. V. E.

Non-Metallic Elements in Connexion with Valency and Specific Gravity. George Woodiwiss (*Chem. News*, 1908, **97**, 265. Compare this vol., ii, 368).—From a consideration of the relationship existing between the valency and specific gravity and specific gravity and atomic weight of the non-metallic elements immediately preceding in Mendeléeff's table the elements of the argon group, evidence is advanced for the valency of these inert elements being 0·5 and not zero. When the quotients of specific gravity divided by the square root of the assumed valency (0·5) of the elements argon, krypton, and xenon are plotted against their atomic weights, it is found that they are in close agreement with other non-metallic elements. J. V. E.

Valency on an Atomistic Electrical Basis. Johannes Stark (*Jahrb. Radioaktiv. Elektronik.*, 1908, **5**, 124—153).—A theoretical paper, part of which has been published previously (compare this vol., ii, 138). An attempt is made to account for chemical action by assuming that the atoms consist of positively charged spheres on the interior surface of which are the relatively minute negative electrons. The forces which operate in the union of two different atoms are entirely of electrical nature, and combination takes place as the result of the partial displacement of the lines of force of such a superficial negative electron (termed a valency electron) from the positive sphere of the atom to which it originally belonged to the positive sphere or spheres of neighbouring atoms. Three kinds of electrons, depending on the way in which the lines of force from the electron are related to the positive spheres of neighbouring atoms, are distinguished. These are classified as unsaturated, saturated, and displaced electrons. On the basis of these three types, the various kinds of dissociation which give rise to the phenomenon of electrical conductivity are explained. The banded spectra of compounds are discussed in reference to the properties of the saturated and the displaced electrons. The line spectra are supposed to be due to internal electrons and not to the valency electrons. Finally, an interpretation of the variation of the valency of the elements along the vertical groups and horizontal series of the periodic table is given. H. M. D.

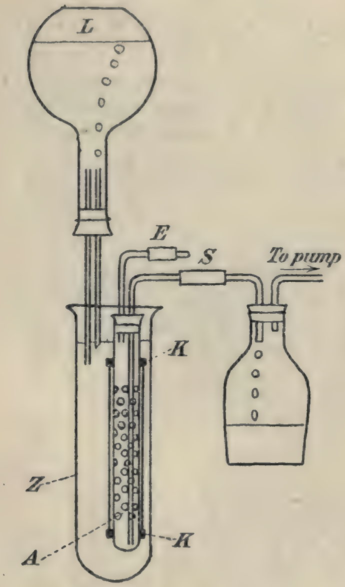
Steam Distillation under Reduced Pressure. Wilhelm Steinkopf (*Chem. Zeit.*, 1908, **43**, 517).—The author suggests the use of this method for separating a substance volatile in steam which is itself decomposed by it, or a substance volatile in steam from substances decomposed at the ordinary temperature by such treatment. Toluene is found to distil with steam at 27·5°/27 mm., aniline at 23°/20 mm., nitrobenzene at 22·5°/19 mm., and a 40% yield of benzoyl chloride is obtained at 21°/16—17 mm. J. V. E.

Receiver for Vacuum Distillation. Gustav Kolbe (*Chem. Zeit.*, 1908, **32**, 487).—A modification of Lothar Meyer's apparatus (Abstr., 1887, 884), the valve plug being made of glass rod instead of glass tubing; the exhaust tube is placed in such a position that none of the distillate can be drawn up into it. By means of a special device, it is possible to exhaust the receiver independently of the rest of the apparatus. P. H.



Apparatus for Simultaneously Extracting a Solid and Filtering the Solution So Obtained. Frederick Record (*Chem. News*, 1908, **97**, 280).—An apparatus devised to obviate the loss of substance which occurs in the course of filtration subsequent to the extraction of solids with such solvents as ether and alcohol. It consists of an inner tube, *A*, sealed to a shorter concentric jacket, *B*, and in that portion of *A* which is within *B* there are two pairs of holes, *C* and *D*. The substance to be extracted, *G*, is placed above a filter disk, *E*, and covered with filter paper and asbestos. A reflux condenser is attached to the upper part of the apparatus, and a flask containing the solvent to the lower end. The vapour from the boiling solvent rises through apertures *D* and *C* into the condenser, from which the liquid drops upon the substance to be extracted, and percolates through to the flask again. J. V. E.

Filter for Filtering Solutions of Definite Concentration at a Temperature Either Above or Below that of the Surrounding Medium. A. LEVITES (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 623—624).—The author has devised a filtering apparatus which may be employed with advantage in cases where the change of concentration occurring when an open filter is employed is to be avoided. Over one end of a glass tube, 4 cm. long and having an internal diameter of about 6 mm., three or four glass fibres, about 1/3 mm. thick, are soldered parallel to one another so as to form a kind of grating. Over this grating is placed a filter paper, which also extends some distance along the tube, and is kept in position by a piece of rubber tubing, the latter serving also to connect the glass tube with a similar shorter piece. The pipette containing the liquid to be filtered may be connected with the filtering apparatus by means of rubber tubing. Suction may be employed to hasten the filtration. T. H. P.



Filtration Apparatus. HANS WISLICENUS (*Chem. Zentr.*, 1908, i, 1238; from *Zeitsch. Chem. Apparat.*, 3, 89—93).—The inner tube *A* is of porcelain or glass, and is perforated by a number of small holes. Over this is wound a broad strip of moistened filter paper, which is kept in position by two indiarubber bands *K.K.* A double bored indiarubber stopper fitting into the mouth of *A* carries two tubes, one of which, *S*, is a suction tube and extends to the bottom of *A*; the other, *E*, reaches only just below the stopper, and is closed during the process of filtration by means of a glass plug on the outside. For ordinary use with cold solutions, the part of the apparatus described is supported in a wide cylinder, *Z*; but when filtration is required to be carried out at a higher or a lower temperature, the cylinder *Z*, containing the tube *A*, is placed in a heating or cooling bath. The liquid in *Z* to be filtered is best maintained at a constant level by the arrangement indicated by *L*. This apparatus has been found most useful when dealing with slimy or colloidal extracts. J. V. E.

Inorganic Chemistry.

Condition of Steam. Emil Bose (*Zeitsch. Elektrochem.*, 1908, **14**, 269—271).—The high density of steam is most readily explained by assuming it to contain single and double molecules in equilibrium, $(H_2O)_2 \rightleftarrows 2H_2O$. The density (air = 1) should then be $\Delta = \delta - K/p(\sqrt{1 + \delta p/K} - 1)$, where δ is 1·2432, the theoretical density for $(H_2O)_2$, p is the pressure, and K is the equilibrium constant at any temperature T. Using determinations of the density made by Kornatz (*Diss.*, Königsberg, 1908), the author calculates $\log K = -4857\cdot1/T + 21455$. The values of the density calculated by these equations show a mean deviation from the experimental results of 0·4%. Regnault showed that the deviations of the vapour density of steam from the theoretical value are a function of the degree of saturation of the steam, that is, of the ratio p/P, where P is the pressure of saturated steam, whereas the author represents them as a function of p/K. It is shown that P is approximately proportional to K, so that formally either ratio may be used. T. E.

Atomic Weight of Chlorine. E. C. Edgar (*Mem. Manchester Phil. Soc.*, 1908, **52**, No. 7, 1—2).—The method used to redetermine this constant was to burn pure dry chlorine at the tip of a quartz jet in an atmosphere of pure dry hydrogen in a quartz combustion vessel, the hydrogen chloride formed being condensed in a limb of it by means of liquid air.

The mean of eight determinations gave the atomic weight of chlorine, calculated from the ratio weight of chlorine burnt/weight of hydrogen burnt, to be 35·194, and from the ratio weight of hydrogen chloride caught–weight of hydrogen burnt/weight of hydrogen burnt, to be 35·193 (at. wt. of hydrogen = 1). If the atomic weight of oxygen is taken as 16, that of chlorine becomes 35·462 and 35·461 respectively, numbers which differ appreciably from that accepted by the International Committee on Atomic Weights, but in close agreement with 35·463 found by Dixon and Edgar and 35·461 found by Guye. J. V. E.

Study of the Oxidation Phenomena Produced by Iodic and Bromic Acids. Henri Baubigny (*Compt. rend.*, 1908, **146**, 1097—1100 [*]).—An ammoniacal solution of silver chloride or bromide when heated at 100° with iodic acid, contrary to the statements in certain text-books, does not give any deposit of silver iodide. The latter is only formed when the temperature has been raised to 200°, and in this case a slight excess pressure in the cooled tube indicates the evolution of a small quantity of gas.

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[*] and *Bull. Soc. chim.*, 1908, [iv], **3**, 767—771.

When 45 c.c. of ammonia (D 0·926) are heated with 1·1 grams of iodic acid in a sealed tube at 210° for five hours, a small amount of gas is evolved and an appreciable quantity of ammonium iodide formed. At 150° very little iodide is produced. In three experiments similar to the above, to each of which 0·256 gram of silver bromide was added, 0·0006 gram of silver iodide was formed at 100°, 0·0021 gram at 150°, and 0·1760 gram at 210°.

The conclusion is drawn that the iodic acid oxidises the ammonia, $NH_4IO_3 + 2NH_3 = NH_4I + 3H_2O + N_2$, giving water, nitrogen, and ammonium iodide, of which the latter reacts with silver bromide, giving the less soluble silver iodide.

Entirely similar results are obtained with bromic acid, which is not completely destroyed in the experiment, showing that it has a certain stability under these conditions. Since therefore no bromic acid could be detected in the mother liquors of the three experiments described above, it is concluded that none is formed (contrary to the assertions of text-books). Similarly, with silver chloride at 210°, no chloric acid is produced. E. H.

Origin of Atmospheric Ozone, and Causes of the Variation of Carbon Dioxide in the Air. H. Henriet and Bonyssy (*Compt. rend.*, 1908, **146**, 977—978).—A preliminary note, in which the authors summarise the conclusions drawn from a series of experiments on the origin of atmospheric ozone, and the causes of the variation of carbon dioxide in the air. Ozone is formed at the expense of the oxygen of the high regions of the atmosphere under the influence of the ultra-violet rays of the sun; it is carried to the lower layers of the air by winds and rain; the proportion of ozone in the air is at a maximum during a West or South-west wind and at a minimum during an East wind, and it is also increased during clear, calm weather by the direct action of the solar radiations on the lower layers of air. The amount of carbon dioxide in the air varies inversely with that of the ozone for values below the normal; for values above the normal, the variation of carbon dioxide is due to local phenomena, such as fog, animal respirations, combustions, &c.

M. A. W.

Vapour Pressure of Sulphur at Low Temperatures. Otto Ruff and Hugo Graf (*Zeitsch. anorg. Chem.*, 1908, **58**, 209—212).—The authors' results for the vapour pressure of sulphur at low temperatures (Abstr., 1907, ii, 947) are considerably higher than those given by Gruener (Abstr., 1907, ii, 860); this is ascribed to the inaccuracy of the method employed by the latter observer. Some fresh determinations at 0° and 49·7° have been made by the method previously used, with the slight modification that a second condensing tube, cooled to −185°, was employed. Hydrogen was used as indifferent gas. The results previously given have to be corrected by adding the vapour pressure of sulphur at 0°/00013 mm. Results are given for temperatures between 49·7° and 211·3°. At 49·7°, 131·9°, and 211·3°, the corrected pressures are 0·00034, 0·081, and 3·14 mm. respectively. G. S.

Hydrogen Persulphides. I. Historical. Crude Hydrogen Persulphide. IGNAZ BLOCH and FRITZ HÖHN (*Ber.*, 1908, **41**, 1961—1971).—The authors give a historical account of the polysulphides of hydrogen from their discovery in 1777. By heating sodium sulphide with varying amounts of sulphur in an atmosphere of hydrogen for three hours on the water-bath and dissolving the products in water, the authors obtain solutes of the composition Na_2S_2, Na_2S_3, Na_2S_4, and Na_2S_5. When the solutions are allowed to flow into mixtures of equal parts of ice and hydrochloric acid (D 1·19) cooled in a freezing mixture, crude hydrogen persulphide is obtained as a yellow, oily liquid with the odour of sulphur chloride and camphor. It is decomposed instantaneously by alkalis, and therefore it is essential that all apparatus used in the preparation should be washed with an acid. The oil can be kept for an hour without visible decomposition. Water decomposes it, but dilute acids, particularly hydrochloric acid, act as preservatives. A criterion of purity is the fact that the freshly-prepared persulphide yields a clear solution in benzene. Alcohols, ether, ethyl acetate, and acetone decompose the oil more or less rapidly, whilst with aldehydes and ketones condensation occurs, yielding substances rich in sulphur. Estimations of the hydrogen and sulphur alone do not suffice to fix the composition of the persulphide, but from the amount of hydrogen sulphide liberated by heating, the authors prove the incorrectness of Rebs' statement (Abstr., 1888, 1155) that the hydrogen persulphide obtained by the decomposition of polysulphides by acids always has the composition H_2S_5. C. S.

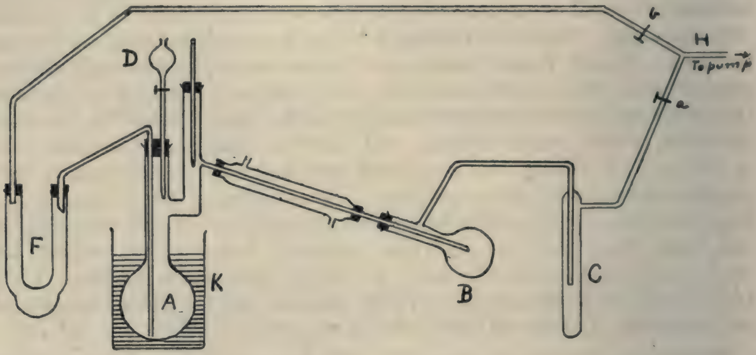
Hydrogen Persulphides. II. Hydrogen Trisulphide. IGNAZ BLOCH and FRITZ HÖHN (*Ber.*, 1908, **41**, 1971—1975).—Crude hydrogen persulphide (preceding abstract) is distilled under reduced pressure. In order to prevent the deposition of sulphur during the distillation, it is necessary to pass dry hydrogen chloride through the apparatus before it is evacuated. The fraction passing over at 69°/2 mm. is collected in three portions, and the middle one analysed. The estimations and the molecular weight in benzene by the cryoscopic method point to the composition H_2S_3.

Hydrogen trisulphide, H_2S_3, m. p. $-52°$ to $-53°$, D^{15} 1·496, is a pale yellow oil, which becomes colourless at lower temperatures. It decomposes slowly in the dark, more quickly in daylight, and rapidly on warming, evolving hydrogen sulphide and depositing rhombic sulphur. It is decomposed slowly by acids, and rapidly by alkalis or alcohols; its solution in ether, benzene, or carbon disulphide is relatively stable. C. S.

Hydrogen Persulphides. III. Hydrogen Disulphide. IGNAZ BLOCH and FRITZ HÖHN (*Ber.*, 1908, **41**, 1975—1980).—By means of the apparatus described later, crude hydrogen persulphide has been separated into hydrogen trisulphide and *hydrogen disulphide*, H_2S_2, b. p. 74—75°, D 1·376, which resembles the trisulphide in many respects, but differs from it in its greater volatility, greater sensitiveness to alkalis, and in the more aggressive character of its vapour. It does not solidify in an ether-carbon dioxide mixture.

The apparatus figured has been designed for the distillation under reduced pressure of large quantities of a liquid in small portions at a time, the residue being removed after the distillation of each portion without disconnecting the apparatus. Its use in the separation of hydrogen di- and tri-sulphides is as follows.

The flask *A*, of 300 c.c. capacity, immersed in the glycerol bath *K*, is connected through the condenser with *B* (150 c.c.), which is attached to the strongly-cooled vessel *C*. By means of a tube reaching to the bottom, *A* is connected with the U-tube *F*. Between *H* and the water-pump are vessels containing soda-lime and calcium chloride, and a manometer. The flask *A* can be connected with the pump either through *B* and *C* by means of the stopcock *a*, or through *F* by the stopcock *b*. To carry out the distillation, the bath *K* is raised to 110—125°, and the apparatus evacuated to about 20 mm., *a* being open and *b* closed. From the dropping funnel *D*, about 15 c.c. of crude hydrogen persulphide is run slowly into *A*. Distillation commences; when it becomes irregular, *a* is closed and *b* opened, whereby the residue in *A* is drawn over into *F*. The distillation is then continued by closing *b*, opening *a*, and introducing another 15 c.c. of hydrogen persulphide into *A* from *D*. The liquid collecting in *B* is mainly hydrogen trisulphide, whilst the more volatile disulphide is found in *C*.



C. S.

Hydrogen Persulphides. IV. Constitution of Hydrogen Disulphide and Trisulphide, and the Chemistry of Sulphur Compounds. IGNAZ BLOCH (*Ber.*, 1908, **41**, 1980—1985).—The relationships of hydrogen di- and tri-sulphides (preceding abstracts) with one another and with other compounds of sulphur are discussed. The author points out that the change of colour of the two sulphides with change of temperature is perhaps explicable by an intramolecular change, $H_2S\colon S \rightleftarrows HS\colon SH$, analogous to keto-enol tautomerism,

$$H_2C\cdot C\colon O \rightleftarrows HC\colon C\cdot OH.$$

Mendeléeff's conception of a homologous series of hydrogen sulphides, H_2S_n, derived from hydrogen sulphide itself by the successive replacement of H by SH receives favourable consideration.

C. S.

Existence of Compounds of Sulphur and Iodine. FRITZ EPHRAIM (*Zeitsch. anorg. Chem.*, 1908, **58**, 338—352. Compare Smith and Carson, this vol., ii, 32).—The freezing-point curve of mixtures of sulphur and iodine has been determined, and the results indicate that the elements do not enter into chemical combination and only form one series of mixed crystals, containing 7—8% of sulphur. Further, boiling-point determinations with the two elements in carbon disulphide afford no evidence of combination in that solvent. The two compounds described by Schneider (Abstr., 1888, 414) as double compounds of iodides of sulphur with arsenic trisulphide and the compound $SnSI_2$ respectively do not exist; the former is a mixture of arsenic trisulphide and iodine and the latter of stannic iodide and sulphur. G. S.

Sulphuric Acid Contact Process. LOTHAR WÖHLER, W. PLÜDDEMANN, and P. WÖHLER (*Zeitsch. physikal. Chem.*, 1908, **62**, 641—677. Compare Wöhler, Foss, and Plüddemann, Abstr., 1906, ii, 846; Wöhler, Plüddemann, and Wöhler, this vol., ii, 290).—The efficiency of any agent in promoting the union of sulphur dioxide and oxygen is measured by the amount of change which it induces under given conditions, such change being expressed as a percentage of the change which would be observed if the system reached its equilibrium position. Numerous experiments have been made in which chromium oxide, copper oxide, cupric and cuprous chromites, aluminium oxide, ferric oxide, thorium, cerium, silicon and titanium dioxides were used as catalytic agents at temperatures up to 900°. In all these cases, it is found that the efficiency, measured in the way already defined, increases regularly as the temperature rises without any sign of a maximum so long as the condition of the catalytic surface is unchanged. The experiments reveal the very marked influence which sintering has in diminishing the efficiency of the catalytic surface, and occasionally observed cases of a temperature of maximum efficiency are shown to be due to this cause.

It appears probable that the relative adsorptive power of variously treated samples of a given catalyst can be taken as a measure of the relative catalytic efficiency of these samples, but there is no such relation between the adsorptive power and the catalytic efficiency of different catalysts.

The authors conclude that the action of catalysts in the sulphuric acid contact process can be equally well explained by supposing the intermediate formation of a solid solution, either of a gas or of a chemical compound, in the surface layer.

In a note added to the paper, the authors discuss the discrepancies between their results (this vol., ii, 290) and those of Keppeler and D'Ans (this vol., ii, 289). J. C. P.

Action of Metals on Aqueous Solutions of the Persulphates. MARIO G. LEVI, E. MIGLIORINI, and G. ERCOLINI (*Gazzetta*, 1908, **38**, i, 583—602. Compare Abstr., 1907, ii, 81).—After discussing the work of Bringhenti (*Atti R. Ist. Veneto*, 1905, **64**, ii, 1321) and Turrentine (this vol., ii, 104), the authors give the results of a study of the action of a large number of metals on solutions of potassium and ammonium persulphates.

All the metals examined, except gold and platinum, react with the persulphate solutions, either passing directly into solution or remaining undissolved in the form of oxides or basic salts. In general, the reaction is slower for ammonium than for potassium persulphate, probably owing to the slightly greater degree of dissociation of the potassium salt; in the catalysis with platinum, the tendency is in the opposite direction.

A special case is presented by magnesium, which reacts with extreme violence with ammonium persulphate, causing evolution of ammonia.

In general, those metals go into solution as anions which in their general chemical behaviour exhibit a marked non-metallic character, such as chromium, manganese, selenium, arsenic, molybdenum, &c.; some metals of this type, however, such as antimony, are transformed into insoluble oxides. The general action with these metals is hence oxidation by the persulphate with intervention of water.

Elements which are distinctly metallic in character pass into solution as cations, the persulphate being decomposed, sometimes with evolution of gas. With zinc, nickel, cobalt, &c., no gas is evolved, and in these cases the reaction is probably represented by $Zn + X_2S_2O_8 = ZnSO_4 + X_2SO_4$, or by (1) $Zn + X_2S_2O_8 + H_2O = ZnO + H_2SO_4 + X_2SO_4$ and (2) $ZnO + H_2SO_4 = ZnSO_4 + H_2O$; according to the latter interpretation, the solution may remain neutral or become acid, this depending on the relative velocities of the reactions (1) and (2). When gas is evolved, this is found to be hydrogen, at any rate for concentrated persulphate solutions.

The reactions studied are, except in the cases of gold and platinum, more chemical than catalytic in nature. They proceed with different velocities for different metals, although the velocity does not always bear any evident relation to the oxidisability of the metal or to its readiness of attack by sulphuric acid. The tendency to form double salts or complexes doubtless plays a part. T. H. P.

Contact Oxidation of Ammonia and Organic Bases. E. I. Orloff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 659—660).—When ammonia is oxidised by the author's contact process (this vol., i, 306), it undergoes transformation mainly according to the equation $4NH_3 + 3O_2 = 2N_2 + 6H_2O$, a small quantity of the nitrogen being also found as nitrous and nitric acids.

Organic bases, such as aniline, toluidine, and pyridine, can also be oxidised in this way. T. H. P.

Reduction of Hydroxylamine at Copper Cathodes. Julius Tafel (*Chem. Zeit.*, 1908, **32**, 135—136).—In reply to Patten (*ibid.*, 44), the author reasserts that hydroxylamine is not reduced at a copper cathode under the conditions expressly stated in his paper (Abstr., 1902, ii, 559). His current researches in conjunction with Hahl (this vol., ii, 175) show that reduction occurs only when the concentration of the sulphuric acid round the cathode falls below a certain value. C. S.

Electrolytic Reduction of Hydroxylamine. Victor Rothmund and O. Flaschner (*Zeitsch. anorg. Chem.*, 1908, **58**, 183—188. Compare Flaschner, Abstr., 1907, ii, 454).—Remarks on Tafel and Hahl's recent paper (this vol., ii, 174). The authors maintain that the use of a stirring arrangement is of great advantage in such investigations.

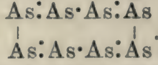
G. S.

Action of Ammonia on Phosphorus. Observations on the Modifications of Phosphorus. Alfred Stock and Otto Johannsen (*Ber.*, 1908, **41**, 1593—1607).—The paper opens with a résumé of the work of various authors on the action of ammonia on phosphorus. As conflicting statements have been made, the question has been re-studied. The present experiments were performed with a specially purified colourless phosphorus, which was freed from traces of arsenic by distillation in a current of steam. The results described show that when colourless phosphorus is treated with liquid ammonia, it is converted more or less completely, depending on the temperature and time of action, into red phosphorus. At the same time, small amounts of a solid hydride and an amide, or imide, of phosphorus are formed; the acid hydride combines with ammonia to form a black salt, which colours the whole mass. When treated with an acid, the red or yellow hydride is liberated, and, on addition of ammonia, again forms the black salt. The amide, when heated, is converted into phosphorus nitride, P_3N_5.

The red phosphorus, prepared by the action of ammonia on the colourless modification, is identical with Schenck's phosphorus (Abstr., 1904, ii, 117); both have D^{22} 2·02, and are soluble in hot dilute sodium hydroxide. Ordinary red phosphorus, D^{22} 2·17, and Hittorf's phosphorus, D^{22} 2·35—2·37, are insoluble in sodium hydroxide. Both forms of red phosphorus have m. p. 600—615°; Hittorf's phosphorus, m. p. 620—625°; colourless phosphorus, when heated, changes into the red modification, and melts above 600°. All four modifications when heated in sealed tubes form a yellow liquid, which, on cooling, commences to deposit red crystals at about 550°. The relations of the four modifications of phosphorus to each other are discussed.

G. Y.

Action of Ammonia on Phosphorus Chloronitride. Adolphe Besson and Rosset (*Compt. rend.*, 1908, **146**, 1149—1151. Compare Stokes, Abstr., 1895, ii, 217).—By acting on phosphorus chloronitride with liquid ammonia, a white *compound*, PN_3H_4, is formed according to the equation $PNCl_2 + 4NH_3 = 2NH_4Cl + PN(NH_2)_2$. This substance is very soluble in water, and, when heated at 220° for several days, loses ammonia and yields phospham, $PN(NH_2)_2 = NH_3 + PN_2H$. When dry gaseous ammonia is passed into a solution of phosphorus chloronitride in dry carbon tetrachloride, slender, silky, prismatic needles are obtained having the composition $P_2N_3H_2Cl_3$, and formed according to the equation $2PNCl_2 + 2NH_3 = NH_4Cl + P_2N_2Cl_3{\cdot}NH_2$. The *compound* is insoluble in ether or carbon disulphide, but dissolves in water with slow decomposition. The carbon tetrachloride drained from the crude product probably contains a mixture of ammonium chloride and the compound PN_3H_4. The action of gaseous ammonia on phosphorus chloronitride may therefore be represented as follows: $3PNCl_2 + 6NH_3 = P_2N_2Cl_3{\cdot}NH_2 + 3NH_4Cl + PN(NH_2)_2$. The chloro-derivative is regarded as an intermediate product, and the compound PN_3H_4 as being formed by using an excess of ammonia. J. C. C.

Polymeric Forms of Metallic Arsenic. Hugo Erdmann and Rudolf Reppert (*Annalen*, 1908, 361, 1—31. Compare Abstr., 1903, ii, 73, 74).—It is found that the transformation of solid, yellow arsenic, As_4, into metallic arsenic, As, under the influence of light takes place in two stages, grey arsenic, which is considered to have the constitution $As\vdots As$, being formed intermediately. The brown modification, D^{20} 3·67—3·69, formed by the action of light on dissolved yellow arsenic, must have the constitution  $\begin{array}{c}As\colon As\cdot As\colon As\\ | \qquad\qquad\quad |\\ As\colon As\cdot As\colon As\end{array}$. This is formed also when dissolved yellow arsenic is treated with oxygen, arsenious bromide, or acetylene tetrabromide, or is allowed to remain in the dark.

An improved apparatus is described and figured for the preparation of a carbon disulphide solution of yellow arsenic. This modification, As_4, D^{-50} 2·35, D^{18} 2·026, is unstable in violet or ultra-violet light, but is converted into metallic arsenic only slowly when exposed to red light; radium rays are without effect on the rate of this change.

Grey arsenic, As_2, D^{20} 4·64, is formed as a by-product in the preparation of the carbon disulphide solution of the yellow polymeride, and is obtained also when the solid yellow arsenic is exposed to light at low temperatures or dissolved yellow arsenic is treated with alcohol or cooled with carbon dioxide and ether or with liquid air. It is stable towards atmospheric oxygen, and is oxidised by nitric acid more slowly than the brown modification or metallic arsenic.

The yellow, grey, and brown polymerides of metallic arsenic do not conduct electricity, whereas metallic arsenic is a conductor. This difference is employed to determine the temperature at which metallic arsenic is formed from its polymerides at a sensible rate. It is found that, when heated, brown arsenic changes into the grey modification, which decomposes into metallic arsenic at about 303°.

When solutions of yellow arsenic and silver nitrate are mixed together, the arsenic, if present in excess, reduces the salt quantitatively to metallic silver, but, if the silver nitrate is in excess, the arsenic is precipitated in the metallic state. Yellow arsenic also precipitates mercury from solutions of mercurous nitrate, and from copper sulphate, a black substance containing 53% to 55% of copper and considerable amounts of arsenic and sulphuric acids. Yellow arsenic therefore is a strong reducing agent, resembling yellow phosphorus, which gives similar reactions. Although isomorphous and chemically closely related, yellow phosphorus and yellow arsenic do not form mixed crystals; this is ascribed to the marked differences in the solubilities. G. Y.

Compounds of Arsenic and Antimony Pentafluoride with Nitrosyl Fluoride. Otto Ruff [with Kurt Stäuber and Hugo Graf (*Zeitsch. anorg. Chem.*, 1908, 58, 325—337. Compare Abstr., 1906, ii, 20).—The compound AsF_5,NOF is obtained pure by passing nitrosyl fluoride, NOF (prepared in the same operation by passing nitrosyl chloride through a platinum tube containing dry silver fluoride and heated to 250—280°), through cooled arsenic trichloride until absorption is complete, the product being finally kept over fused sodium hydroxide in a vacuum for some time to absorb traces of nitrosyl chloride. The compound forms a white, crystalline mass, and is remarkably stable; it is unaffected in dry air even at a high temperature, but decomposes in moist air; it is split up by water, by alkali, and by concentrated hydrochloric acid, but is unacted on by phosphorus trichloride, carbon tetrachloride, silicon, copper, lead, and other substances. On warming gently with antimony pentafluoride, arsenic pentafluoride and the solid antimony compound described below are obtained.

The corresponding antimony compound, SbF_5,NOF, is obtained in an analogous way by the action of nitrosyl fluoride on antimony pentachloride, but more simply by interaction of nitrosyl fluoride and a solid antimony chlorofluoride, $(SbF_5)_2,SbCl_5$. (The latter compound is obtained by the action of chlorine on antimony trifluoride, and will be described later.) The chlorofluoride and nitrosyl chloride are mixed in a tube at −80°, and the mixture allowed to warm up; the tube is then sealed, and kept for one to two hours at room temperature with occasional shaking. The compound occurs in slender, colourless needles, which sublime without decomposition below a red heat; it is very hygroscopic, and is decomposed by water and by alcohol. On warming with arsenic trifluoride, it gives arsenic pentafluoride mixed with excess of the trifluoride, and, on heating with potassium fluoride, it yields nitrosyl fluoride and a compound of antimony pentafluoride and potassium fluoride. G. S.

Absorptive Power for Air of Certain Varieties of Vegetable Carbon. ARNALDO PIUTTI and G. MAGLI (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1908, [iii], **14**, 68—75).—The density and absorptive power for air of different forms of carbon are tabulated in the original. The absorption was carried out at the temperature of liquid air, and the air absorbed driven off by heating the carbon gradually to a temperature of 550°.

The maximum absorption is shown by the carbon of cherry-stones and cocoanut-shell (about 280 and 250 times the volume respectively); this absorption is increased nearly 20 per cent. by a preliminary treatment of the material with chlorine. With the exception of that from carob seed, the surface of which is not sufficiently porous, the absorptive power of charcoal from any material is nearly proportional to its density. W. A. D.

Solutions of the Alkali Metals in Liquid Ammonia. OTTO RUFF and JULIAN ZEDNER (*Ber.*, 1908, **41**, 1948—1960. Compare Ruff and Geisel, Abstr., 1906, ii, 228; Joannis, *ibid.*, ii, 161; 1907, ii, 459; Kraus, Abstr., 1907, ii, 935).—The boiling-point and the melting-point curves of solutions of lithium, sodium, and potassium in liquid ammonia at different concentrations have been plotted. The boiling-point curves at small concentrations are of the usual type, but the b. p.'s of solutions containing more than 8 (atomic) % of the metal begin to rise rapidly, indicating possibly the existence of compounds.

In particular, the behaviour of sodium in ammonia has been examined at temperatures below the boiling points at atmospheric pressure. Above $-46°$, only one liquid phase exists at any concentration, but below this temperature, separation into two liquid phases or one solid and one liquid phase occurs. Evidence of the existence of compounds has not been obtained, except perhaps at the eutectic point, $-111°$, where the composition corresponds with the formula $Na(NH_3)_5$.

Saturated solutions of lithium, sodium, and potassium boil at temperatures which are practically the same as those at which Moissan first observed a reaction between the metal and liquid ammonia. C. S.

Extraction of Potassium from Felspathic Rock. ALLERTON S. CUSHMAN and PREVOST HUBBARD (*J. Amer. Chem. Soc.*, 1908, **30**, 779—797).—The object of the experiments was to obtain a remunerative process for extracting potassium from rocks for agricultural purposes. A certain amount of the potassium of felspars is dissolved by water when the mineral is finely ground, and the amount dissolved is increased by addition of substances such as ammonium salts, lime, and gypsum. Complete solution of the potassium can be effected by means of an electrolytic method, both with and without addition of hydrofluoric acid; the method would, however, probably be too costly for practical purposes. Attacking the silicates by means of potassium hydroxide or carbonate, &c., or with hydrofluoric acid, are suggested as possible methods which should receive further study.

Diagrams are given showing the amounts of potassium dissolved by water and the action of acids in relation to fineness and to duration of action. As regards the action of water, it is shown that the amount of potassium dissolved does not increase in exact ratio to the increase of surface area, probably owing to increased coagulation as the particles decrease in size. N. H. J. M.

Polyiodides of Potassium, Rubidium, and Cæsium. HARRY W. FOOTE and W. C. CHALKER (*Amer. Chem. J.*, 1908, **39**, 561—567).—Abegg and Hamburger (Abstr., 1906, i, 747) have made a study of the polyiodides of the alkali metals, and have concluded that the following salts exist as stable solids at 25°: KI_7; RbI_3, RbI_7, RbI_9; CsI_3, CsI_5 or CsI_7, and CsI_9. Johnson (Trans., 1877, 249) has described the compound KI_3, whilst Wells and Penfield (Abstr., 1892, 773) and Wells and Wheeler (Abstr., 1893, ii, 67, 68) have prepared the salts RbI_8, CsI_3, and CsI_5, but were unable to obtain higher iodides of potassium than KI_3.

From experiments on the solubility relations of the cæsium periodides, Foote (Abstr., 1903, ii, 367) concluded that CsI_3 and CsI_5 were the only compounds found at the temperatures investigated. A similar study has now been made of the solubility relations of the polyiodides of potassium, rubidium, and cæsium at 25°, and the composition of the residues has been determined. The results prove the existence of the salts KI_3, RbI_3, CsI_3, CsI_5, and KI_7, but do not give any indication of the formation of the compounds RbI_7, RbI_9, CsI_7, and CsI_9. E. G.

Explosion Produced by an Ordinary Reagent. Camille Matignon (*Bull. Soc. chim.*, 1908, [iv], **3**, 618—619).—On attempting to move a glass vessel containing an ammoniacal solution of silver oxide which had been left for twenty-four hours, a violent explosion occurred. This was found to be due to the formation of silver nitride, or products intermediate between this and the oxide, according to the equation $3AgOH + NH_3 = NAg_3 + 3H_2O$.

The mixture constitutes Berthollet's fulminating silver, and had dried on the surface of the glass. Such a solution should therefore be thrown away after use. J. C. C.

Compounds Formed by Silver Selenide with the Selenides of Arsenic, Antimony, and Bismuth. Henri Pélabon (*Compt. rend.*, 1908, **146**, 975—977).—The freezing-point curves of mixtures of silver selenide with the selenide of antimony or bismuth, obtained by plotting the number of mols. of the added selenide per 100 mols. of the silver selenide as abscissæ against the freezing point of the mixture as ordinates, are closely similar, and consist of four branches, showing two minima and one maximum; the latter corresponds with the freezing point of the *compound*, $3Ag_2Se,4Sb_2Se_3$, f. p. 650°, or

$$3Ag_2Se,4Bi_2Se_3,$$

f. p. 773°, respectively. The freezing-point curve of mixtures of silver and arsenic selenide shows a maximum corresponding with the freezing point of the *compound* $3Ag_2Se,4As_2Se_3$.

Similar evidence was obtained of the existence of compounds of silver selenide with the lower selenides of antimony (Chrétien, Abstr., 1906, ii, 550); these *compounds* are represented by the formulæ $SbSe,\frac{1}{2}Ag_2Se$, Sb_8Se_4,Ag_2Se, and $4Sb_4Se_5,5Ag_2Se$ respectively. M. A. W.

Chemical Properties of Calcium. Hugo Erdmann and Heinrich van der Smissen (*Annalen*, 1908, **361**, 32—68).—As calcium is now prepared technically on the large scale, it was thought of interest to undertake a systematic investigation of the chemical properties of the metal. The calcium employed in the experiments now described was chiefly filings from the electrolytic metal. For some experiments, crystalline calcium was prepared by reduction of calcium iodide by Moissan's method.

Whilst readily attacked by air or liquid nitrogen (Erdmann, Abstr., 1906, ii, 349; Jordis and Rosenhaupt, this vol., ii, 172), calcium is highly stable towards dry oxygen. Calcium oxide and mercury are formed only on prolonged heating of 1% calcium amalgam in a current of oxygen at 400—500°; mercuric oxide also is formed if the oxygen is ozonised. The formation of calcium peroxide could not be detected. On the other hand, calcium is oxidised so rapidly in presence of moisture that, whilst when cut under mercury the fresh surface of the metal is amalgamated instantaneously, a surface which has been exposed to moist air for a quarter of a second is amalgamated only at 100—200°.

Contrary to statements in the literature, calcium hydride, whilst energetically attacked by water, is extremely stable towards anhydrous reagents. With certain precautions, calcium hydride is recommended as a source of pure hydrogen, as also for the preparation of hydrogen on the large scale.

Calcium nitride, Ca_3N_2 (Maquenne, Abstr., 1892, 776), is prepared by passing a current of nitrogen through fused calcium in an iron crucible, or by the action of liquid nitrogen on the metal. Contrary to Kaiser's statement (French Patent, 350966, 1905), ammonia is not formed when hydrogen is passed over calcium nitride or nitrogen over the hydride at 500—800° (compare Haber and Oordt, Abstr., 1905, ii, 159, 384, 814).

Moissan has shown (Abstr., 1899, i, 410 ; ii, 152, 153) that calcium reacts with ammonia at $-78°$ to 20°, forming calcium ammonia, $Ca(NH_3)_4$, but at 500—1000°, forming calcium nitride and hydride, whilst an analogous derivative of methylamine cannot be obtained. It is now found that calcium reacts with ethylamine at 250—400°, yielding hydrogen, nitrogen, calcium nitride, calcium hydride, and carbon. On the other hand, calcium reacts with aromatic amines, forming compounds of the type $(NHR)_2Ca$.

Calcium anilide, $(NHPh)_2Ca$, prepared by heating calcium with aniline in an atmosphere of hydrogen at 200°, is obtained as a white, microcrystalline powder, D 1·17, which is insoluble in organic solvents, decomposes when exposed to moist air, explodes in dry oxygen, and yields aniline and calcium hydrate when treated with water, or aniline and calcium salts with acids. When treated with oxygen highly diluted with nitrogen at $-20°$, the anilide absorbs 1·3 atoms of oxygen for each atom of calcium, and forms a black, resinous mass of basic character. With ethyl iodide at the ordinary temperature, the anilide forms ethylaniline ; with benzoyl chloride in ethereal solution, benzanilide ; with gaseous carbonyl chloride, carbanilide ; with carbon disulphide, thiocarbanilide ; with sulphur dioxide, a yellow *product*, which evolves sulphur dioxide when heated ; and with carbon dioxide, *calcium phenylcarbamate*, $(NHPh\cdot CO_2)_2Ca$. Heat is developed by the reactions with carbon disulphide, sulphur dioxide, and carbon dioxide. Calcium phenylcarbamate is formed also when calcium is heated with aniline at 250° in an atmosphere of carbon dioxide ; when heated, it decomposes, forming calcium carbonate and carbanilide.

Calcium o-*toluidide*, $(NH\cdot C_7H_7)_2Ca$, formed from calcium and *o*-toluidine at 240°, resembles the anilide. It absorbs carbon dioxide, forming *calcium* o-*tolylcarbamate*, $(C_8H_8O_2N)_2Ca$, which is decomposed by acids, forming carbon dioxide, *o*-toluidine, and the calcium salts, and, when heated, yields calcium carbonate and *s*-di-*o*-tolylcarbamide.

Calcium p-*toluidide*, formed from calcium and *p*-toluidine at 260°, absorbs carbon dioxide, forming *calcium* p-*tolylcarbamate.*

Calcium diphenylamide, $(C_{12}H_{10}N)_2Ca$, prepared from calcium and diphenylamine at 355°, is obtained as a white powder, which is attacked only slowly by dry oxygen, becomes green in presence of dry air, decomposes, developing heat on exposure to moist air, and explodes in moist oxygen. It is attacked only slowly by water or dilute acids, but forms diphenylamine and calcium sulphate with concentrated sulphuric acid. It yields the following substances when treated with the reagents named.

With benzoyl chloride, diphenylbenzamide; with carbonyl chloride, tetraphenylcarbamide; with an excess of carbonyl chloride, diphenylcarbamyl chloride, and with carbon dioxide, *calcium diphenylcarbamate*, which is obtained as a white powder, and when heated yields tetraphenylcarbamide.

Calcium reacts with the naphthylamines at 280°, evolving hydrogen and small amounts of ammonia, and forming a yellow, brittle glass. At 240°, calcium and *p*-anisidine form a brown *product*, which becomes dark blue on exposure to air. Calcium reacts also with ethylaniline at 240°, forming a brown *product*, which is sensitive to light; with acetamide at 140°, forming a gelatinous *substance*, and with acetanilide at 200°, forming, amongst other products, acetaldehyde and anilide. Calcium and benzidine do not react at 420°.

Phenylhydrazine reacts with calcium slowly at 100° and rapidly at 140—160°, forming nitrogen, hydrogen, ammonia, benzene, aniline, and a white *powder*, $C_{18}H_{18}N_4Ca$ (?), which is attacked violently by dry oxygen, and absorbs carbon dioxide with development of heat.

Contrary to Moissan's statement (Abstr., 1900, ii, 76), calcium hydride does not react with sulphur dioxide or with acetylene (Abstr., 1899, ii, 153). When heated with calcium at 400°, fluorene evolves hydrogen and forms a black mass, but, under the same conditions, benzene, naphthalene, tetraphenylmethane, and acenaphthene remain unchanged. On the other hand, ethyl acetate reacts with calcium at 300°, or in presence of traces of alcohol at 150°.

Ethyl calcioacetoacetate, $(C_6H_9O_3)_2Ca$, formed from calcium and ethyl acetoacetate at 150°, is obtained as a white, crystalline powder, m. p. 215—220° (decomp.) if rapidly, or decomp. 180° if slowly, heated. Also, ethyl ethylacetoacetate reacts with calcium at 170°, evolving hydrogen. A pure product could not be obtained. Ethyl malonate and calcium evolve hydrogen at 160—180°, forming a yellow, flocculent *product*, which could not be purified. G. Y.

A New Calcium Silicide. L. Hackspill (*Bull. Soc. chim.*, 1908, [iv], 3, 619—621).—A new *calcium silicide*, Si_2Ca_3, is obtained by heating to 1000° a mixture of calcium filings and powdered silicon compressed in a hole, 4—5 mm. diameter, bored in a calcium cylinder fitting in an iron test-tube, which is placed in a porcelain tube. On cooling, excess of calcium is removed by sugar solution, and the remaining slender needles are washed with alcohol and ether. The silicide is readily powdered, and has D_4^{14} 1·64. It is attacked by halogens in the cold, and by oxygen at a red heat. With dilute mineral acids, it is decomposed with evolution of spontaneously inflammable silicon hydrides. J. C. C.

Micrography of Cement. E. Stern (*Ber.*, 1908, 41, 1742—1745).—Hardened cements, or cements in the process of hardening, have been examined micrographically in reflected light by the method employed for metals and alloys. The etched sections show the original cement particles, *A*, composed mainly of alite, and a portion, *B*, in which the process of hardening takes place; very little alteration in appearance occurs during the hardening process, although *B* slowly increases at the expense of *A*. The sections yield characteristic results when etched with alkalis, alcoholic hydrochloric acid, alcoholic iodine solution, or 25% hydrofluoric acid. Portland cement and iron-portland cement can be distinguished by this micrographic process.

The action of salt solutions, sea-water, &c., has been examined, and also the effect of high temperature. J. J. S.

Cæsium Dicalcium Sulphate. JOH. D'ANS (*Ber.*, 1908, 41, 1776—1777).—In continuation of his study of double sulphates (Abstr., 1906, ii, 751; 1907, ii, 168; this vol., ii, 104, 289), the author has prepared *caesium dicalcium sulphate*, $Ca_2Cs_2(SO_4)_3$, by adding gypsum to a solution of cæsium sulphate. It forms crystals similar to those of ammonium and rubidium dicalcium sulphates, and is extremely stable, the stability increasing with the temperature. Attempts to prepare a salt analogous to syngenite, or a pentacalcium salt, have been unsuccessful. The temperature limit of stability of the calcium double sulphates falls as the mol. weight of the alkali sulphate increases. Whilst potassium syngenite is stable far above 100°, rubidium syngenite decomposes above about 40°; on the other hand, whilst ammonium dicalcium sulphate exists only above 80°, cæsium dicalcium sulphate is formed below 0°.

A thallium calcium sulphate could not be prepared. G. Y.

Neutral Triple Sulphates of Calcium. JOH. D'ANS (*Ber.*, 1908, 41, 1777—1779).—Only two neutral triple sulphates of calcium, the naturally-occurring polyhalite, $Ca_2MgK_2(SO_4)_4,2H_2O$ (Basch, Abstr., 1901, ii, 168), and krugite, $Ca_4MgK_2(SO_4)_6,2H_2O$ (Geiger, Abstr., 1904, ii, 268), have been studied previously. The observation of the formation of a polyhalite, in which the magnesium is displaced by copper by the action of copper sulphate solution on potassium syngenite, has led the author to investigate the formation of such triple sulphates.

It is found that polyhalites, in which the magnesium is displaced by copper, cadmium, nickel, or zinc, and the potassium by ammonium, are formed when gypsum is boiled with suitably concentrated solutions of the other two sulphates. The synthetical salts crystallise more readily than the naturally-occurring triple sulphates; the *copper ammonium* and *copper potassium* salts are light blue. Analyses are quoted of the *dicalcium copper diammonium*, $Ca_2Cu(NH_4)_2(SO_4)_4,2H_2O$, and *dicalcium cadmium dipotassium*, $Ca_2CdK_2(SO_4)_4,2H_2O$, sulphates.

These results have lead to the synthesis of polyhalite by boiling gypsum, or a mixture of this with syngenite, with a concentrated solution of magnesium sulphate containing about 4% of potassium sulphate. G. Y.

Composition of Artificial Magnesite Stone. FELIX CORNU (*Centr. Min.*, 1908, 305—310).—The basic refractory bricks used for lining iron furnaces, which are made by igniting the coarsely crystalline magnesite (or rather breunnerite, since it contains 3·2—3·5% iron) from Veitsch in Styria, were found to consist largely (94%) of a crystalline aggregate of grains of periclase together with some glassy material. Enclosed in the grains of periclase are skeletal growths of magnesioferrite. L. J. S.

Amalgamated Zinc. Charles M. van Deventer (*Chem. Weekblad*, 1908, **5**, 356—359).—A theoretical paper, reviewing the theories advanced to explain the lack of activity displayed by amalgamated zinc towards dilute sulphuric acid. A. J. W.

New Reaction of Thallous Salts. Fritz Ephraim (*Zeitsch. anorg. Chem.*, 1908, **58**, 353—355).—A clear aqueous solution of antimony chloride and potassium iodide gives with an acid or neutral solution of any thallous salt a characteristic voluminous, orange to cinnabar-red precipitate of the compound $3TlI,2SbI_3$. Thallous salts in a dilution of 1 in 20,000 can be detected in this way, but the compound cannot be used for the quantitative determination of thallous salts, as it is decomposed by water. G. S.

Effect of Glass and Traces of Organic Substances on Mercuric Chloride Solution. Willem van Ryn (*Pharm. Weekblad*, 1908, **45**, 636—637).—Dilute aqueous solutions of mercuric chloride (1 : 4000 to 5000), preserved in corked bottles, are completely reduced in a few days either to a mixture of mercuric oxychloride and mercurous chloride or to mercurous chloride only. The author attributes the reduction to the action of the glass, of the cork, and of traces of organic matter in the solution. A. J. W.

Resolution of Ytterbium into its Elements. Carl Auer von Welsbach (*Monatsh.*, 1908, **29**, 181—225).—It was stated in a previous communication (Abstr., 1907, ii, 26) that the fraction obtained during the separation of the elements of the ytterbium group, which should have contained pure ytterbium, gave a spark spectrum which differed considerably from the ytterbium spectrum; for instance, the four lines in the green, $\lambda = 5353·0$, 5347·4, 5345·9, and 5335·2, so characteristic of ytterbium had almost disappeared. The conclusion was drawn therefore that the ytterbium had partly been resolved. At the same time, a fraction was obtained between the erbium and thulium fractions which gave a spectrum termed Erγ. This fraction has been further investigated, and by repeated fractional precipitation of the oxalate by ammonium oxalate a fraction was finally obtained which gave a spark spectrum in which the lines which were missing or were very faint in the first-mentioned spectrum, for example, the four lines in the green, were exceedingly intense.

Large quantities of the fractions containing the two new substances were therefore carefully fractionated by repeated precipitation of the oxalates, and finally two fractions were obtained which could not be further resolved. It is proposed to name the two new elements so obtained *aldebaranium* (Ad) and *cassiopeium* (Cp). Their atomic weights, determined by conversion of the oxides into sulphates, were found to be Ad = 172·9 and Cp = 174·23 (O = 16). The two elements cannot be distinguished one from the other by chemical means; they, of course, possess the chemical properties ascribed to ytterbium.

The principal lines of the spark spectrum of aldebaranium are λ = 5353·0, 5347·4, 5345·9, 5335·2, 4786·8, 4726·0, 4181·0, 3988·2, 3694·3, 3289·5, and 2750·6; of cassiopeium, λ = 6222·0, 6160·2, 5984·0, 5476·9, 5135·2, 4994·3, 4785·5, 4684·0, 4184·4, 3694·3, 3554·6, 3507·6, 3472·7, 3397·2, 3289·5, 2911·5, 2900·4, 2895·0, and 2615·5. The two spectra combined practically give the spectrum of ytterbium, but there are nevertheless some lines present in the spectrum of the latter, for example, λ = 5104·6, 5067·4, and 5009·7, which do not appear in the spectra of aldebaranium or cassiopeium. It is therefore evident that ytterbium also contains a third unknown element.

The original contains a complete list of the wave-lengths of the lines of the spark spectra of ytterbium, aldebaranium, and cassiopeium, also reproductions of the photographs of these spectra. W. H. G.

Silicon-Aluminium Alloys. WALTER FRAENKEL (*Zeitsch. anorg. Chem.*, 1908, **58**, 154—158).—The aluminium used in the investigation contained nearly 99% of the pure metal; the specimen of silicon contained 96·6% of that element and about 1% of aluminium.

The elements are miscible in all proportions in the fused state, and do not enter into chemical combination. The freezing-point curve consists of two branches; the eutectic mixture contains about 10% of silicon, and solidifies at 576°. Whether mixed crystals are formed could not be satisfactorily determined; if they exist, those rich in aluminium do not contain more than 0·5% of silicon, and those rich in the latter element not more than 2% of aluminium. There is some evidence that silicon, like bismuth, expands on solidification. G. S.

Aluminium Silicates. FRITZ ULFFERS (*J. pr. Chem.*, 1908, [ii], **77**, 549—552. Compare Abstr., 1907, ii, 776).—Polemical. A reply to Jordis (this vol., ii, 291). G. Y.

Manganese and its Alloys with Carbon. A. STADELER (*Metallurgie*, 1908, **5**, 260—267, 281—288).—Manganese, prepared by the Goldschmidt method, contains 1·3% Si, 1·46% Al, and 1·05% Fe. The silicon may be removed by fusion with potassium permanganate, but the iron is less readily oxidised than the manganese, and, as the loss by volatilisation is considerable, dry refining of the manganese is impracticable.

In the investigation of the manganese-carbon alloys, the mixtures were fused in crucibles, lined with magnesite, in a current of nitrogen.

The maximum solubility of carbon in manganese at 2000° is 6·72%, corresponding with the carbide, Mn_3C. The mixtures solidify to form a continuous series of mixed crystals, having a maximum freezing point at 1271° and 3·32% C, and falling to the freezing point of the carbide at 1217°. The metallographic examination of quenched alloys confirms the existence of mixed crystals, visible as polyhedra in alloys containing less than 3·32% C, and as long needles in alloys richer in carbon. At a lower temperature, rising from 817° at 0·72% C to

855° at 3·60% C, these crystals break up into other mixed crystals, one series of which is nearly pure manganese, and the other rich in carbide. Alloys containing more than 3·60% C have the same structure whether slowly cooled or quenched.

Manganese does not take up carbon when heated in sugar charcoal for twelve hours at 1100°.

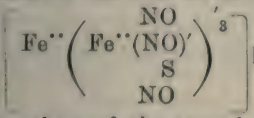
Manganese carbide, Mn_3C, has D 6·888, and is readily oxidised. Alloys containing more than 3% of carbon fall to pieces at once in water, and even disintegrate spontaneously in closed vessels after a few weeks, apparently owing to the evolution of retained gas.

C. H. D.

Preparation of Electrolytic Iron. Richard Amberg (*Zeitsch. Elektrochem.*, 1908, **14**, 326—328).—Electrolytic iron was prepared in quantities of 240 to 1000 grams by electrolysis of a solution of ferrous ammonium sulphate containing not less than 26 grams of iron per litre with a cathodic current density of 0·002 to 0·0065 ampere per sq. cm. With the highest current density, a stirrer was used. The anodes of wrought iron were enclosed in linen bags, and the surface of the bath protected from the air by a layer of solid paraffin. The iron, after removal of hydrogen, contained over 99·9% of iron, but difficulty was experienced with the anode mud. T. E.

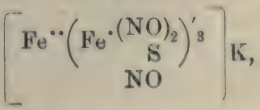
Optical Method for Determining the Relative Hardness of Contiguous Structural Elements of Alloys. M. K. Cigler (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 584—591).—Soft iron nails were heated in boiling sulphur. Sections were prepared, and the hardness of the different parts determined by an optical method. The results show that the first product of the interaction of iron and sulphur at 448° is ferrous sulphide, which is afterwards converted into ferric sulphide by the further action of the sulphur. T. H. P.

Probable Constitutional Formulæ of the Ferronitrosulphides. Italo Bellucci and Pietro de Cesaris (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 545—552. Compare this vol., ii, 499).—The authors have studied (1) the conversion of ferronitrosulphides of the first series into those of the second series, which takes place according to the equation $2[Fe_4(NO)_7S_3]K + 4KHO = 6[Fe(NO)_2S]K + Fe_2O_3 + N_2O + 2H_2O$, and (2) the reverse change, which is expressed by the equation $4[Fe(NO)_2S]K + CO_2 + H_2O = [Fe_4(NO)_7S_3]K + H_2S + KNO + K_2CO_3$. Consideration of these results and of the products of decomposition of the anions $[Fe_4(NO)_7S_3]'$ and $[Fe(NO)_2S]'$ in alkaline and acid media (*loc. cit.*) leads the authors to propose for ferronitrosulphides of the first series the formula



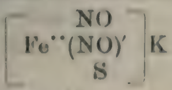
$$\left[\mathrm{Fe}^{\cdot\cdot}\left(\begin{array}{c}\mathrm{NO}\\ \mathrm{Fe}^{\cdot\cdot}(\mathrm{NO})'\\ \mathrm{S}\\ \mathrm{NO}\end{array}\right)'_{3}\right]\mathrm{K}$$

or



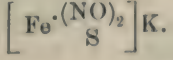
$$\left[\begin{array}{c}\mathrm{Fe}^{\cdot\cdot}\left(\mathrm{Fe}^{\cdot}\begin{array}{c}(\mathrm{NO})_2\\ \mathrm{S}\end{array}\right)'_{3}\\ \mathrm{NO}\end{array}\right]\mathrm{K},$$

and for those of the second series the formula



$$\left[\begin{array}{c}\mathrm{NO}\\ \mathrm{Fe}^{\cdot\cdot}(\mathrm{NO})'\\ \mathrm{S}\end{array}\right]\mathrm{K}$$

or



$$\left[\mathrm{Fe}^{\cdot}\begin{array}{c}(\mathrm{NO})_2\\ \mathrm{S}\end{array}\right]\mathrm{K}.$$

All the known reactions of the ferronitrosulphides are explained by either pair of these formulæ. T. H. P.

Alloys of Lead and Cobalt. F. DUCELLIEZ (*Bull. Soc. chim.*, 1908, [iv], **3**, 621—622).—Apparently homogeneous alloys of lead and cobalt can be obtained by subjecting mixtures of the two metals to hydraulic pressure, and then heating the masses so prepared at 1400° in magnesia crucibles in a current of hydrogen. Products made in this way and containing from 22·8% to 95·1% of cobalt behaved as mixtures of the two metals, and did not contain any definite compound. Vigouroux has already shown that, in like manner, nickel and lead form no definite compound (*Proc. verb. Soc. Sci. phys. nat.*, *Bord.*, Nov. 21, 1907). T. A. H.

Reduction and Oxidation of Nickel Oxide under the Ordinary and High Pressures. WLADIMIR IPATIEFF (*J. pr. Chem.*, 1908, [ii], **77**, 513—532. Compare Moissan, Abstr., 1881, 74).—A study of the part played by nickel oxide in the mechanism of catalytic reductions (Abstr., 1907, i, 828). The results of experiments on the action of hydrogen on nickelic and nickelous oxides at varying temperatures and under different pressures are tabulated. It is found that nickelic oxide is reduced to nickel by hydrogen under the ordinary pressure at 190—200°, whereas nickelous oxide, which appears to be present always in commercial nickelic oxide, is not reduced under the ordinary pressure below 200°; but under high pressures it is reduced at 172°, unless first heated before the blowpipe, when reduction takes place only slowly at 250°.

If reduced below 270° and exposed to air at the temperature of the reduction, nickel inflames and is oxidised to nickelous oxide, but, if reduced at 270—280°, it is oxidised by dry air or oxygen only at 350°, or completely, forming nickelous oxide, at 400°, and can then be reduced by hydrogen under the ordinary pressure only at 300°. The temperature of oxidation of reduced nickel is lowered by the presence of moisture. Nickelous oxide is not oxidised by dry or moist air or oxygen under the ordinary or higher pressure within the temperature interval 220—480°.

Experiments on the reduction of the oxides of nickel by hydrogen under high pressures in presence of benzene show that, under these conditions, nickelic oxide is reduced to only a very slight extent at 250°, but the reduction of nickelous oxide takes place at the same temperature, 172°, as in the absence of benzene. If heated before the blowpipe, nickelous oxide reduces benzene catalytically only above 200°, and is itself only very slightly reduced.

These results are in agreement with the author's view that the catalyst in such reductions is nickelic oxide, and that the reduction is facilitated by the presence of moisture. G. Y.

Isomerism of Chromium Salts. PAUL PFEIFFER (*Zeitsch. anorg. Chem.*, 1908, **58**, 317—324. Compare this vol., i, 506, 507, 508).—The paper contains a summary and bibliography of the 29 types of isomerism which have so far been observed for chromium salts. G. S.

Chromium Chlorosulphate. RUDOLF F. WEINLAND and TH. SCHUMANN (*Zeitsch. anorg. Chem.*, 1908, **58**, 176—182. Compare Abstr., 1906, ii, 233; 1907, ii, 623).—A green chlorosulphate of chromium, $[CrCl,5H_2O]SO_4,3H_2O$, in which the SO_4 group, but not the chlorine, is ionised, is already known (compare Recoura, Abstr., 1902, ii, 563; Weinland, *loc. cit.*). The authors have now prepared the isomeric compound $[CrSO_4,5H_2O]Cl$, in which the chlorine, but not the SO_4, is present as ion, as follows. Violet chromium sulphate, $Cr_2(SO_4)_3,17H_2O$, is heated at 80° until it loses $3\frac{1}{2}H_2O$ and is uniformly green, then dissolved in water, kept for three hours, cooled, and saturated with hydrogen chloride, when the salt in question separates as a green, crystalline powder.

When hydrogen chloride is led for a short time into a cooled saturated solution of the compound $[CrCl,5H_2O]SO_4,3H_2O$, a salt of the formula $CrCl_3,6H_2O$ separates in slender, bluish-green needles. As rather more than two-thirds of the chlorine is precipitated by silver nitrate in nitric acid solution, the salt is probably a monochlorochromium dichloride (compare Bjerrum, Abstr., 1907, ii, 622).

G. S.

Complex Molybdates of the Rare Earths. GIUSEPPE A. BARBIERI (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 540—545).—Conductivity and cryoscopic measurements of salts of the rare earths with strong acids (compare Muthmann, Abstr., 1898, ii, 586; Ley, Abstr., 1900, ii, 67; Meyer and Aufrecht, Abstr., 1904, ii, 175) show that, in aqueous solution, these salts are highly dissociated and hence only slightly hydrolysed. The rare earth metals have therefore a high electro-affinity, which is certainly greater than that of aluminium. The present paper describes the first of a series of investigations on the tendency of the rare earth metals to form complex ions, a tendency which is in inverse ratio to the electro-affinity.

Ammonium ceromolybdate, $(NH_4)_6Ce_2Mo_{14}O_{48},24H_2O$, forms orange-red, monoclinic prisms, which give a solution of the same colour, whilst *ammonium lanthanomolybdate*, $(NH_4)_6La_2Mo_{14}O_{48},24H_2O$, forms white, transparent crystals having a faint yellow tint. T. H. P.

Silicides of Tungsten and of Molybdenum. EDOUARD DEFACQZ (*Bull. Soc. chim.*, 1908, [iv], **3**, 577—578).—A question of priority (compare Abstr., 1907, ii, 475, 676; Hönigschmid, *Chem. Zeit.*, 1907, **31**, 595; Abstr., 1907, ii, 877). T. A. H.

Complex Acids. I. ARTURIO MIOLATI and R. PIZZIGHELLI (*J. pr. Chem.*, 1908, [ii], **77**, 417—456).—A simple method for the study of the capacity of acids to form complex compounds with other acids has now been founded on the employment of the electrical conductivity as an indicator on the neutralisation of acids (Abstr., 1901, ii, 381). If an increasing amount of a substance is added to a solution of a second substance with which it reacts, some property of the solution, such as the specific electrical conductivity, must be a linear function of the proportion of the two substances in the solution. When the reaction is complete, a further addition of the substance must influence the property measured to another extent, and hence a break must occur in the graph representing the rate of change. If two reactions take place successively, the graph must show two breaks, but, if the reactions are simultaneous, the property in question cannot be a linear function, and caution is required in interpreting the curve. In the light of these considerations, the authors have determined the electrical conductivities of solutions of molybdic acid containing varying amounts of other acids.

The graph for the electrical conductivity of solutions of molybdic and phosphoric acids shows one break at the proportion

$$P_2O_5 : MoO_3 = 1 : 20,$$

whilst that for solutions of molybdic acid and disodium hydrogen phosphate has two breaks at the proportions $P_2O_5 : MoO_3 = 1 : 5$ and 1 : 16. Breaks occur in the graph for solutions of molybdic and arsenic acids at $As_2O_5 : MoO_3 = 1 : 5$ and 1 : 20, and in the graph for molybdic and methylarsonic acids at the proportions

$$AsMeO_3H : MoO_3 = 2 : 5 \text{ and } 1 : 10.$$

Complex compounds of molybdic and methylarsonic acids have not been described. The graph for molybdic and cacodylic acids has one break at $AsMe_2O_2H : MoO_3 = 1 : 4$. The bearing of these observations on the existence of complex salts described by previous authors is discussed.

The basicity of phosphotungstic acid has been studied in the manner employed in the study of yellow phosphomolybdic acid (Abstr., 1904, ii, 263). Similar results are obtained, the electrical conductivity diminishing until 6 mols. of sodium hydroxide have been added, and then increasing steadily until the addition of 26 mols. of sodium hydroxide, the increase being still more rapid on further additions of alkali.

The paper closes with a long discussion of the constitution of the complex inorganic acids. Those containing $12MoO_3$ or $12WO_3$ may be conceived as derivatives of acids of the type $(Mo)_6H_n$, in which the whole of the co-ordinated oxygen atoms are displaced by the bivalent anion Mo_2O_7 or W_2O_7. The basicity of the resulting acid is the difference between the sum of the basicities of the co-ordinated, negative acid groups and the positive valency of the central atom. Hence phosphomolybdic, $[P(Mo_2O_7)_6]X_7$, phosphotungstic, $[P(W_2O_7)_6]X_7$, and arsenomolybdic, $[As(Mo_2O_7)_6]X_7$, acids are heptabasic, whereas silicomolybdic, $[Si(Mo_2O_7)_6]X_8$, silicotungstic, $[Si(W_2O_7)_6]X_8$, and cobaltomolybdic, $[Co(Mo_2O_7)_6]X_8$, acids are octabasic. If the complex acid contains less than twelve MoO_3 groups, the number of these is related to the number of hydroxyls in the anion, each hydroxyl being capable of combining with two MoO_3 groups. Thus the conductivity graph for mixtures of molybdic and dichloroplatinic acids has breaks at the proportions $H_2PtCl_2(OH)_4 : MoO_3 = 1 : 2$ and 1 : 8. G. Y.

Electrolytic Formation of Peroxygenated Compounds of Tin. ANGELO COPPADORO (*Gazzetta*, 1908, **38**, i, 489—508).—When concentrated alkali stannate solutions are electrolysed at low temperatures and with low current densities, perstannates are formed, owing to anodic oxidation. The proportion of perstannate formed is only small, a condition of equilibrium being soon reached between the perstannate formed and decomposed. The addition of alkali fluoride to the electrolyte increases the rate of formation of the perstannate, but does not change the final equilibrium, so that the yield of perstannate remains unaltered. The presence of fluorine ions does not increase the anodic potential during electrolysis, and the conclusion is drawn that the fluorine enters into combination, forming either a stable perfluorine salt or an intermediate compound which favours the oxidation of the stannate. The fact that perstannates are formed even at low current densities shows that their formation is due to secondary oxidation of the stannate by the nascent oxygen rather than by the union of two stannic anions. The yield of perstannate diminishes rapidly as the temperature of electrolysis rises. In solution at the ordinary temperature, the perstannates undergo gradual decomposition, yielding stannates. T. H. P.

Phosphides of Titanium and Zirconium. JULIUS GEWECKE (*Annalen*, 1908, **361**, 79—89. Compare Moissan, Abstr., 1895, ii, 272; Chenevix, *Gmelin-Kraut*, II, **2**, 15; Rose, *Ann. Phys. Chem.*, 1832, [ii], **24**, 141; Wöhler, *Annalen*, 1853, **87**, 375).—When treated with hydrogen phosphide in the cold, titanium chloride forms a yellow, crystalline substance, which on being heated decomposes, yielding hydrogen phosphide, hydrogen chloride, and small amounts of titanium phosphide. A sketch is given of a convenient apparatus for carrying out these reactions. Titanium phosphide, TiP, forms a brittle mass with metallic lustre, D_4^{25} 3·95, burns when heated in air or when fused with potassium nitrate, is a conductor of electricity, is insoluble in dilute or concentrated acids or alkalis, and is oxidised to only a small extent when boiled with *aqua regia* or heated with fuming nitric acid at 250—300°. When heated in chlorine, the phosphide burns, forming white fumes of titanium chloride and phosphorus pentachloride, which condense as a yellow *sublimate*, $TiCl_4,PCl_5$.

Zirconium phosphide, ZrP_2, forms a glistening, grey mass, D_4^{25} 4·77, and closely resembles the titanium phosphide in its physical and chemical properties. When sublimed in a current of hydrogen over heated potassium phosphide, zirconium tetrachloride formed a black *mass* containing potassium chloride, zirconium, phosphorus, and oxygen, which may have been derived from the presence of zirconium oxychloride.

Silicon tetrachloride reacts with hydrogen phosphide, forming a *silicon phosphide*, whereas thorium tetrachloride does not appear to react even at high temperatures. G. Y.

Thorium Oxyfluoride and Fluoride. ED. CHAUVENET (*Compt. rend.*, 1908, **146**, 973—974).—When hydrated thorium fluoride (Chydenius, *Jahresb.*, 1863, 194) or silicofluoride is heated at 800° in a platinum tube in a current of dry hydrogen fluoride, it is converted into the *oxyfluoride*, $ThOF_2$, a white, insoluble, amorphous powder yielding hydrogen fluoride on decomposition with sulphuric acid.

Thorium fluoride, ThF_4 (Moissan and Étard, Abstr., 1896, ii, 422;

Duboin, this vol., ii, 297), is obtained as an amorphous powder, which cannot be decomposed by sulphuric acid when thorium bromide or chloride is heated at 350—400° in a current of dry hydrogen fluoride.

M. A. W.

Mercuri-iodides of Thorium and Aluminium. ANDRÉ DUBOIN (*Compt. rend.*, 1908, **146**, 1027—1028).—When thorium iodide, prepared by the action of hydriodic acid on thorium carbonate, and mercuric iodide are alternately dissolved in water at a gentle heat to saturation, the liquid on cooling deposits, first, mercuric iodide and then a mass of extremely deliquescent crystals of *thorium mercuri-iodide*, $ThI_4,5HgI_2,18H_2O$, easily decomposed by water, and quickly changed by exposure to air, becoming red. The mother liquor is dark brown in colour, owing to the presence of free iodine, and the latter is removed by shaking with mercurous iodide, giving a yellow liquid, $D^{18·9}$ 3·512.

It has been shown previously that a saturated solution of mercuric iodide in aluminium iodide solution deposits an oxyiodide when left in dry air (Abstr., 1907, ii, 955). The mother liquor from this experiment, kept since then in the presence of anhydrous baryta, has deposited a very small quantity of elongated prisms of *aluminium mercuri-iodide*, $AlI_3,HgI_2,8H_2O$, which is extraordinarily deliquescent, but dissolves in water without decomposition.

E. H.

Hypovanadic Acid and Some of its Compounds. GUSTAVE GAIN (*Ann. Chim. Phys.*, 1908, [viii], **14**, 224—228).—A résumé of work already published, with additional observations (compare Abstr., 1907, ii, 32, 97, 558, 627; 1908, ii, 284). The two isomeric hydrates of hypovanadic acid dissolve readily in dilute aqueous solutions of hydrogen chloride or hydrogen bromide, and by evaporation the corresponding halogen salts are obtained in well-defined crystals (compare Guyard, Abstr., this Journ., 1876, ii, 173; Crow, *ibid.*, 453). The chloride, $VO_2Cl_2,8H_2O$, is deep green when prepared from the green hydrate, but is blue when obtained from the rose hydrate, $VO_2Br_3,5H_2O$, and forms large, rectangular tablets; an aqueous solution is intensely red, but becomes deep blue on the addition of hydrogen bromide in excess. The iodide was not obtained sufficiently pure for analysis; it forms a red aqueous solution turning blue on the addition of hydrogen iodide.

When the mixture of oxides (V_2O_3 and V_2O_4) resulting from the calcination of ammonium vanadate is treated in boiling aqueous solution with sulphur dioxide, a blue liquid is obtained, from which, under suitable conditions, the following salts can be isolated:

$$V_2O_4,2SO_2,6H_2O,$$

a blue, crystalline crust soluble in water; $V_2O_4,SO_2,4·5H_2O$, a deep green, amorphous substance sparingly soluble in cold water;

$$V_2O_4,2SO_2,16H_2O,$$

small, sky-blue crystals; $V_2O_4,2SO_2,8H_2O$, blue crystals. An aqueous solution of selenious acid dissolves the hydrate of hypovanadic acid, and, by allowing the solution to evaporate, pale blue, microscopic crystals of $V_2O_4,2SeO_2,4H_2O$ are obtained.

The author has also succeeded in obtaining a number of definite crystalline compounds by the union of hypovanadic acid with sulphuric acid. Some of these have already been described by Gerland and by Crow (*loc. cit.*), although only in the gummy or amorphous condition (compare Koppel, Abstr., 1902, ii, 85; 1903, ii, 551). A description of the following salts is given: $V_2O_4,2SO_3,3H_2O$, elongated, deep blue prisms; $V_2O_4,2SO_3,5H_2O$, very bright blue, microscopic crystals; $V_2O_4,4\cdot5SO_3,11H_2O$ and $V_2O_4,5SO_3,12H_2O$ are very hygroscopic, blue, microcrystalline powders; $V_2O_4,2\cdot5SO_3,9H_2O$, azure-blue crystals; on ignition V_2O_5 is obtained; $V_2O_4,3SO_3,10H_2O$, turquoise-blue crystals; $V_2O_4,3\cdot5SO_3,10H_2O$, stable, bluish-green crystals. A new *selenate* has also been obtained in the form of a blue, microcrystalline powder having the composition $V_2O_4,3\cdot5SeO_3,7H_2O$.

Hypovanadic acid dissolves in nitric acid, forming a blue solution, but, when allowed to evaporate, this deposits the red hydrate of vanadic acid. A nitrate could not be obtained. The following nitrites are obtained by dissolving $V_2O_4,2H_2O$ in aqueous solutions of the alkali nitrites: $(V_2O_4,N_2O_3)(K_2O,N_2O_3),4H_2O$, colourless, regular hexagonal prisms; $[V_2O_4,N_2O_3][(NH_4)_2O,N_2O_3],6H_2O$, pale yellow prisms. The corresponding *sodium* salt is obtained as a colourless, very unstable powder.

Hypovanadic acid unites with many organic acids, forming stable salts. The formate, $V_2O_4(CHO_2)_2,2H_2O$, is obtained as azure-blue crystals, which are less soluble in alcohol than in water. The *acetate*, $V_2O_4(C_2H_3O_2)_2,5H_2O$, is a greenish-blue, crystalline mass. The *oxalate*, $V_2O_4(C_2O_4)_3,7H_2O$, forms elongated, greenish-blue prisms. The *malonate* and *salicylate* are blue, whilst the *succinate* is green.

The following new double sulphites have been prepared by treating the alkali hydrogen sulphites with an aqueous solution of hypovanadic acid: $3(V_2O_4,SO_2),2(K_2O,SO_2),5H_2O$, small, blue crystals;

$$2(V_2O_4,SO_2),(K_2O,SO_2),2H_2O,$$

large, deep blue crystals; $(V_2O_4,2SO_2),2[(NH_4)_2O,SO_2],2H_2O$, well-formed, greenish-blue crystals; $5(V_2O_4,SO_2),2[(NH_4)_2O,SO_2],16H_2O$, a bluish-green substance, rapidly turning brown;

$$2(V_2O_4,SO_2),(Rb_2O,SO_2),4H_2O,$$

brilliant azure-blue crystals; $(V_2O_4,SO_2),2(Tl_2O,SO_2),4H_2O$, emerald-green plates; $2(V_2O_4,SO_2),(Na_2O,SO_2),4H_2O$, bright green crystals, sparingly soluble in cold water.

The paper contains an account of the methods adopted for the analysis of the foregoing compounds. W. O. W.

Action of Potassium Iodide and Hydrochloric Acid on Antimonic Acid. A. Kolb and R. Formhals (*Zeitsch. anorg. Chem.*, 1908, 58, 189—201. Compare Youtz, Abstr., 1904, ii, 150).—The oxidation of hydriodic acid by antimonic acid in the presence of hydrochloric acid according to the equation $Sb_2O_5 + 4HI \rightleftharpoons Sb_2O_3 + 2H_2O + 2I_2$ is a reversible reaction, and the same equilibrium point can be reached from both sides. The influence of varying concentrations of the reacting substances and of certain other compounds on the equilibrium point has been investigated systematically. When potassium iodide and especially hydrochloric acid are used in considerable excess, the reaction is practically complete in the direction indicated by the upper arrow, which is of importance for the volumetric estimation of antimony compounds. Tartaric acid diminished the amount of iodine set free, and neutral salts increase it, as does rise of temperature. If cadmium iodide is used instead of potassium iodide, less iodine is set free.

The probable mechanism of the reaction is discussed. G. S.

Hardness of Alloys. III. ALEXIS V. SAPOSHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 665—673. Compare Abstr., 1907, ii, 869).—The hardness curve for alloys of antimony and bismuth exhibits a maximum at the composition $Sb_{4\cdot05}Bi$, but does not indicate whether or not these two metals form a continuous series of solid solutions (compare Hüttner and Tammann, Abstr., 1905, ii, 327). The hardness curve for aluminium-tin alloys has also been constructed. The hardness falls rapidly as the percentage of tin present increases from 0 to 30, then rises to reach a maximum for 40% of tin, falls again, and attains another maximum very nearly at the composition AlSn. T. H. P.

Atomic Weight of Bismuth. II. Synthesis of Bismuth Oxide. ALEXANDER GUTBIER and LOTHAR BIRCKENBACH (*J. pr. Chem.*, 1908, [ii], **77**, 457—471. Compare Abstr., 1906, ii, 92).—Bismuth oxide has been formed by the action of nitric acid on three specimens of bismuth: (*a*) prepared by Schneider's process (Abstr., 1895, ii, 114): (*b*) prepared by a modification of Classen's method (Abstr., 1890, 706; 1891, 525; 1892, 20), and (*c*) a specimen supplied by Classen. Four experiments with (*a*) gave the mean value Bi = 208·03; four with (*b*) gave Bi = 207·99, whilst two with (*c*) gave Bi = 208·00. The extreme values obtained were Bi = 207·88 and Bi = 208·20. The value 208·0 (O = 16), which is now recommended as the atomic weight of bismuth, is in agreement with the joint results of the work of Schneider (*loc. cit.*) and Löwe (Abstr., 1884, 558). G. Y.

Electrolysis of Bismuth Salt Solutions. ALEXANDER GUTBIER, LOTHAR BIRCKENBACH, and R. BÜNZ (*Chem. Zentr.*, 1908, i, 1256; from *Sitzungsber. Erlangen Physik-Med. Soc.*, **39**, 172—175).—The previously observed bronze-coloured coating which covers the anode in a bismuth solution, and settles as small, lustrous plates to the bottom of the vessel, becomes redissolved on continuing the electrolysis. It is, however, formed in largest quantities from a solution of 20 grams of bismuth in 200 c.c. of nitric acid (D 1·4) diluted to 1500 c.c. with water containing 300 c.c. of concentrated ammonia solution in 2 litres, using $1·0—1·5^{-2}$ amp./qcm. When the electrolyte is slowly replaced by water, the metallic lustre of this substance suddenly disappears, and a light brown, amorphous powder remains, consisting of 97·93% Bi_2O_3 with about 2% active oxygen. J. V. E.

Optical Properties of Colloidal Gold Solutions. WALTER STEUBING (*Ann. Physik.*, 1908, [iv], **26**, 329—371).—When gold chloride solutions are reduced by means of hydrazine, red, blue, or violet colloidal solutions of gold may be obtained. The solutions are very stable, and the colour depends on the temperature, the concentration, and the rapidity with which the reducing agent is mixed with the gold solution. The blue and red solutions both contain particles of uniform size, and both colours are given by solutions which contain particles of very different sizes. The colour of the colloidal gold does not therefore depend on the size of the particles, but there appear to be two distinct kinds of particles, the one giving rise to the red, and the other to the blue colour. The violet solutions contain both kinds of particles.

The author describes a method of measuring the light emitted laterally from the colloidal solutions when these are subjected to the influence of rays in a particular direction. This diffused light represents a very small fraction of the incident light, which is apparently absorbed. It is plane polarised to a large extent, and in the case of the light emitted at right angles to the direction of the incident beam, the proportion of plane polarised light has a maximum value of 90%.

When examined in the ultra-microscope by means of polarised light, the red and blue solutions exhibit considerable differences, and these are supposed to be due to differences in the geometrical form of the two kinds of particles. The laterally emitted light from the red solutions exhibits a maximum intensity in the region 560—570 $\mu\mu$; that from the blue solutions a feeble maximum at 570 $\mu\mu$ and a more strongly pronounced one in the red region. Violet solutions behave like a mixture of the red and blue solutions. A maximum of absorption is shown by red solutions at 525—530 $\mu\mu$, and a minimum by blue solutions at 490 $\mu\mu$; the absorption effects of the blue solutions are, however, not so sharply defined as those of the red.

Greyish-green colloidal solutions of gold have also been obtained by reduction with hydrazine in presence of a little potassium hydroxide. These solutions emit very little light laterally, and show fairly uniform absorption. It is supposed that the particles in these solutions are formed by condensation of the particles which give rise to the red and blue colours. H. M. D.

Action of Silver Nitrate on Chloroauric Acid and the Preparation of Fulminating Gold. Jules Jacobsen (*Compt. rend.*, 1908, **146**, 1213—1214).—On adding silver nitrate to a solution of chloroauric acid, a brown *precipitate* is obtained according to the equation $HAuCl_4 + 4AgNO_3 + 3H_2O = Au(OH)_3,4AgCl + 4HNO_3$.

By the action of ammonia, this is converted into fulminating gold, which has the formula $Au(OH)_2{\cdot}NH_2$ or $(AuN,2H_2O),H_2O$. The substance, when washed with aqueous ammonia, followed by water, alcohol, and ether, and dried at a low temperature, explodes violently when touched with a knife. The explosion takes effect in a downward direction. On boiling fulminating gold with potassium hydroxide, a blackish-brown, flocculent *product* is obtained, which is still more explosive, and probably has the composition $Au(OH)_2{\cdot}NH{\cdot}Au(OH)_2$. J. C. C.

Passivity of Platinum. Rudolf Ruer (*Zeitsch. Elektrochem.*, 1908, **14**, 309—314).—Previous experiments (Abstr., 1903, ii, 407) led to the view that the insolubility of a platinum anode was due to a coating of a peroxide. The coatings observed by Marie (Abstr., 1907, ii, 698) may be the peroxide in question. Further experiments show that the coating is formed with pure platinum in sulphuric acid containing from 2½ to 10% of the acid. In stronger acids, no visible coating is formed. The coating is yellow to brown in colour; it is insoluble in cold sulphuric acid alone, but dissolves in presence of a reducing agent. It is a good conductor of electricity. The potential of a coated electrode is the same as that of one saturated with oxygen; it falls gradually to the potential of platinum charged with atmospheric oxygen. The coating has therefore the properties of the hypothetical peroxide, but, since it is not formed in 50% sulphuric acid and, in fact, dissolves when a coated plate is used as anode in acid of this strength, it cannot explain the insolubility of platinum in the strong acid. T. E.

Definite Compounds of Silicon and Palladium. Paul Lebeau and Pierre Jolibois (*Compt. rend.*, 1908, **146**, 1028—1031).—Boussingault has shown (Abstr., 1876, 47; 1879, 286) that palladium combines with silicon to the extent of 3·9%. When an intimate mixture of palladium and crystallised silicon is introduced into a porcelain crucible heated by means of a blowpipe, a contraction first occurs, and then, at 500—600°, combination is produced, accompanied by a bright incandescence and sufficient elevation of the temperature to cause complete fusion. The fusion temperature of mixtures of silicon and palladium varies largely with the content of silicon. With an increasing proportion of silicon, the m. p. falls from 1587° for pure palladium to the minimum 670°, corresponding with 6% of silicon; it then rises rapidly to the maximum 1400° for 11·76% of silicon (corresponding with $SiPd_2$); the m. p. then again falls, reaching a second minimum of 750° for 16% of silicon, and afterwards rising to a second maximum of 990° for 21% of silicon (corresponding with SiPd). With 25% of silicon there occurs another minimum of 825°, corresponding with an eutectic, and then the m. p. rises gradually to that of pure silicon. Observation of the rate of cooling of the mixtures shows that, for all those containing less than 20% of silicon, a well-defined slackening takes place, followed by a recalescence, the rise in temperature being sufficient to raise the mass to a bright red heat. The increase in incandescence so observed starts at a point in the mass and spreads in a manner similar to the crystallisation of a supersaturated solution, and the similarity in the two phenomena is further shown by the fact that the recalescence is prevented by contact of the mixture at the commencement of solidification with a small fragment of a similar ingot previously prepared. The behaviour, on cooling, of mixtures containing more than 21% of silicon, indicates the presence of the eutectic (SiPd—Si).

Comparison of different ingots which have undergone recalescence with the same products, tempered before the appearance of this phenomenon, reveals an interesting difference in structure. In the latter case, two homogeneous constituents are always observed, and are very easily distinguished by oxidation. When, however, recalescence has occurred, the more oxidisable constituent is besprinkled with small crystals.

The ingots corresponding with the compositions $SiPd_2$ and SiPd are both homogeneous, but only the latter silicide has been isolated in a crystalline form. When ingots containing above 60% of silicon are treated with dilute potash, the free silicon dissolves, leaving small, very brilliant, bluish-grey fragments of *palladium silicide*, SiPd, D^{15} 7·31, which, when hot, is attacked by fluorine and chlorine, is superficially oxidised by oxygen at a dull red heat, is attacked by cold nitric acid and aqua regia, but not by hydrochloric or sulphuric acid, and is slowly attacked by alkali hydroxides. E. H.

Mineralogical Chemistry.

Proustite and Argentite from Colorado. Frank R. Van Horn (*Amer. J. Sci.*, 1908, [iv], **25**, 507—508).—A vein of argentiferous galena occurring in the California or Bell mine near Montezuma in Summit Co., Colorado, contains blende and chalybite together with some proustite (anal. I), and argentite (anal. II); the last two are massive and intimately intermixed with quartz:

	Ag.	As.	Sb.	S.	Insol.	Total.
I.	67·60	13·85	0·93	17·40	—	99·78
II.	83·57	—	—	12·66	3·62	99·85

L. J. S.

Composition of Certain Chilian Caliches. Franz W. Dafert [with A. Halla and R. Waschata] (*Monatsh.*, 1908, **29**, 235—244).—The results of complete analyses of several samples of natural Chili saltpetre from Santa Clara are recorded. It is found that, although several caliches contain perchlorate, there are others which do not, whilst all contain more or less iodate. As a rule, the caliches rich in sodium nitrate also contain considerable quantities of potassium nitrate and small amounts of chromate.

The author discusses the bearing of his results on the various theories which have been put forward to explain the formation of saltpetre deposits. W. H. G.

Paligorskite Group. A. Fersmann (*Bull. Acad. Sci. St. Petersburg*, 1908, [vi], 637—666).—The author makes a critical comparison of all the analytical data published concerning the members of the paligorskite group, which he divides into the following classes: (1) Paramontmorillite, having the general composition $H_{12}Al_2Si_4O_{17}$; (2) α-paligorskite, $H_{32}Mg_2Al_4Si_{11}O_{46}$; (3) β-paligorskite, $H_{20}Mg_2Al_2Si_7O_{29}$; (4) α-pilolite, $H_{28}Mg_4Al_2Si_{10}O_{41}$; (5) β-pilolite, $H_{36}Mg_6Al_2Si_{13}O_{53}$; (6) parasepiolite, $H_8Mg_2Si_8O_{12}$; (7) ferruginous paligorskite. The arrangement under this classification of the minerals known as mountain leather, mountain cork, lassalite, morencite, hydrous anthophyllite, &c., is explained.

The constitution of the basic series of the paligorskite group may be explained by the assumption of an orthosilicate (*A*) in the nucleus and an aluminosilicate or ferrisilicate (*B*) in the side-chain, the relations between these two silicates being expressed by simple whole numbers. In the extreme members of the series, there may be a deviation from these relations, owing to the presence of other silicates in varying proportions. The analytical numbers indicate that the group cannot consist of isomorphous mixtures of the two silicates, *A* and *B*, neither is the constitution in accord with an equivalent substitution of the magnesia of sepiolite by alumina. T. H. P.

A New Variety of Paragonite Mica. Philippe Barbier (*Compt. rend.*, 1908, **146**, 1220—1221).—A specimen of silvery mica, resembling muscovite in appearance, from Mesvres, near Autun, was analysed with the following results: loss on ignition, 4·60 (fluorine is absent); the calcined material gave:

SiO_2.	Al_2O_3.	Fe_2O_3.	K_2O.	Na_2O.	Li_2O.	Total.
49·18	36·56	2·19	3·12	7·63	1·26	99·94

The mineral is therefore a lithium-bearing variety of soda-mica, and for it the name *hallerite* is proposed. L. J. S.

Gedrite from Canada. N. Norton Evans and J. Austen Bancroft (*Amer. J. Sci.*, 1908, [iv], **25**, 509—512).—Gedrite, the aluminous variety of anthophyllite, occurs abundantly as a constituent of amphibolite in the township of Harcourt, Haliburton Co., Ontario. The amphibolite is associated with limestone and granite of Laurentian age, and contains, in addition to anthophyllite, garnet and cordierite, with subordinate amounts of quartz, biotite, iron-ore, and rutile. The anthophyllite has the form of sheaves of long, narrow crystals of a delicate clove-brown colour and characteristic pleochroism; it is optically negative with straight extinction. Analysis of material separated from the powdered rock by means of an electromagnet and heavy liquids gave the following results, agreeing with Rammelsberg's formula $4RSiO_3,Al_2O_3$, where $R = Mg, Fe, H_2$:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	H_2O.	K_2O,Na_2O.	Total.
44·32	16·04	2·80	16·88	0·09	0·77	15·95	1·31	1·86	100·02

The mineral is thus very similar to the original gedrite from Gèdres, in the Pyrenees. Neither anthophyllite nor cordierite have before been recorded from Canada. L. J. S.

Delorenzite, a New Mineral. Ferruccio Zambonini (*Zeitsch. Kryst. Min.*, 1908, **45**, 76—81*).—The mineral occurs associated with strüverite (this vol., ii, 398) in the pegmatite of Craveggia, Piedmont. The crystals are orthorhombic [$a:b:c = 0·3375:1:0·3412$], with prismatic habit closely resembling polycrase; they are black and opaque, but thin splinters are brown and isotropic. The fracture is conchoidal, with a brilliant pitchy to resinous lustre. Hardness

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* and *Rend. Accad. Sci. Fis. Mat. Napoli*, 1908, [iii], **14**, 113—118.

$5\frac{1}{2}$—6; D about 4·7; the mineral is strongly radioactive. Analysis by J. S. Štěrba gave:

TiO_2.	SnO_2.	UO_2.	Y_2O_3.	FeO.	Total.
66·03	4·33	9·87	14·63	4·25	99·11

This corresponds with the formula $2FeO,UO_2,2Y_2O_3,24TiO_2$, or written as a metatitanate, $2FeTiO_3,U(TiO_3)_2,2Y_2(TiO_3)_3,7(TiO)TiO_3$. The new mineral is thus nearer to yttrocrasite (Abstr., 1907, ii, 103) than to polycrase in composition. L. J. S.

Physiological Chemistry.

Influence of the Amount of Carbon Dioxide in the Respired Air on the Changes in Weight of Butterfly Pupæ. MARIA (GRÄFIN) VON LINDEN (*Bied. Zentr.*, 1908, **37**, 427—429; from *Arch. Physiol.*, 1907, 162. Compare Abstr., 1906, ii, 95).—Experiments with two varieties of chrysalides show that carbon dioxide is absorbed, and that their existence as chrysalides is more prolonged in an atmosphere rich in carbon dioxide than in air. Carbon dioxide does not act as a narcotic, but acts rather as a stimulant, without, however, causing loss of weight, and the conclusion is drawn that carbon dioxide is a direct nutrient. N. H. J. M.

The Influence of the Reaction of Blood-plasma on the Formation of Fibrin. GUSTAVE PATEIN (*J. Pharm. Chim.*, 1908, [vi], **27**, 518—522).—The addition of salts of calcium to an oxalated plasma produces no coagulum if the mixture is first made acid with acetic acid. The addition of alkalis produces the coagulum as soon as the reaction of the mixture is alkaline, provided that the mixture has not remained acid for very long. If, however, the mixture of oxalated plasma, calcium salt, and acetic acid has stood for a day, the addition of alkali fails to produce a coagulum. In this case, coagulation can be made to take place by the addition of normal serum. The fibrin ferment seems to have been destroyed by remaining for a long time in acid solution. S. B. S.

Albumose in the Blood. EMIL ABDERHALDEN (*Biochem. Zeitsch.*, 1908, **10**, 277—282).—Polemical mainly against Freund. The present author withdraws none of his previous statements regarding the absence of albumoses in blood, blood-serum, and blood-plasma.

W. D. H.

Origin of the Saccharifying Power of Human Saliva. W. MESTREZAT (*Bull. Soc. chim.*, 1908, [iv], **3**, 711—713).—Preparations of saliva extracted under aseptic conditions from the parotid and submaxillary glands are shown to possess the property of saccharifying starch mucilage, that from the parotid gland being the more active. A mixture of the two secretions has a saccharifying power approximately the mean of those due to the two acting separately, and similar to that of ordinary saliva. The hydrolysis of starch by the latter is therefore due to a diastase (ptyalin) of glandular origin, and not to the action of bacteria occurring in the mouth (compare Duclaux, *Traité de Microbiologie*, 1899, 2). T. A. H.

The Diastase in Cat's Saliva. ANTON J. CARLSON and J. G. RYAN (*Amer. J. Physiol.*, 1908, 22, 1—15).—Diastase is present in the blood in greater concentration than in the saliva; an increase in salivary diastase occurs after intravenous injection of human ptyalin and pancreatic amylopsin. Concentration of organic solids and of salivary diastase vary together. There is more diastase in the submaxillary than in the parotid saliva. These results were obtained by experiments on the cat; a few experiments made on dogs confirm them. W. D. H.

Milk Curdling in the Infant's Stomach. ALOIS KREIDL and ALFRED NEUMANN (*Zentr. Physiol.*, 1908, 22, 133—136).—In the stomach of the sucking child and animal, rennin is present, and causes curdling of various kinds of milk. Whether curdling of human milk takes place was not observed directly, but it probably does, for the juice contains both acid and rennin, and curdles human milk *in vitro*. W. D. H.

Remarks on Aron and Sebauer's Work on the Nutritive Value of Calcium Salts. ARNOLD ORGLER (*Biochem. Zeitsch.*, 1908, 10, 236—239. Compare this vol., ii, 208).—A criticism of Aron and Sebauer's methods and results. W. D. H.

Specific Dynamic Action of Proteins. NATHAN ZUNTZ (*Zentr. Physiol.*, 1908, 22, 67—68).—The views of Graham Lusk (this vol., ii, 574) on this question are criticised. The heat value of lactic acid in the body is greater, not less, than that of alanine if allowance is made for the unburnt nitrogenous residue it yields. The work of the alimentary canal during digestion, involving as it does muscular and glandular activity lasting for many hours, cannot be a negligible factor in metabolism. W. D. H.

Metabolism of Injected Proteins, Immunity and Hypersensitiveness. ULRICH FRIEDEMANN and S. ISAAC (*Chem. Zentr.*, 1908, 1, 967; from *Zeitsch. expt. Path. Ther.*, 1907, 4, 830—866).—The authors, in continuation of their former work (*ibid.*, 1905, 1, 573), have sought an explanation of the fate of proteins injected into the organism of dogs and of larger herbivora (goats and sheep). They found that during starvation such proteins cause a general rise in protein decomposition, such as follows protein administration by the alimentary tract. The increased nitrogen excretion will follow the injection of sera, either of the same or of other animals, as well as egg-proteins. In the case of dogs in nitrogenous equilibrium, protein injection on carbohydrate-free diet causes increased protein decomposition, which can be inhibited by the addition of carbohydrates to the diet. The fact that proteins of different origin exert the same influence on nitrogenous excretion stands in contrast with their behaviour when tested by biological methods (precipitin and complement reactions). The parallelism between the nutrition phenomena and these biological phenomena is entirely wanting, for precipitins can be detected in the blood long after the injected proteins are eliminated from the body. From the facts, the authors conclude that the precipitable substances circulating in the serum are not identical with the injected protein.

The authors also noticed a characteristic phenomenon of hypersensitiveness in the case of dogs, in that a second injection following a preliminary injection of the same quantity of substance often causes acute intoxication leading to a fatal result. They ascribe this to a sudden inundation of the organism with toxic metabolism products, and compare this phenomena with what happens in diabetic coma, uræmia, and the alimentary intoxication observed by Finkelstein in infants. S. B. S.

Proteid Minimum in the Food of Cows. (*Bied. Zentr.*, 1908, 37, 393—413; from 60*th* and 63*rd Ber. Dänisch. Versuchslab.*, 1906 and 1907).—Nine cows were fed with hay (2·5 kilos.), straw (3·7—4·88 kilos.), and with different amounts of roots (increasing from 30 kilos. in the first period to 45 kilos. in the seventh) and cotton cake (decreasing from 2·5 to 1·5 kilos.). The amount of water consumed diminished as the amount of roots increased, so that the percentage of water in the total food remained about the same (80·8—82·5%). The food contained in the first period 221 grams of protein and 31 grams of amide nitrogen; in the fourth period, 128 and 35 grams respectively. The effect of reducing the amount of nitrogen, is diminution of nitrogen in the fæces and especially in the urine; the amount of excrement remained the same. The percentage of nitrogen in the milk was not altered, but the amount of milk was reduced. The first result of reducing the supply of nitrogen is to diminish the nitrogen of the urine, then that of the fæces, and thirdly that of the milk. When the amount is further reduced, nitrogen from the body is utilised for milk production for a short time, after which the yield of milk rapidly falls. Provided the amount of food is sufficient, the composition is unimportant, and may vary from year to year according to the magnitude of the crops, deficient crops being supplemented with suitable amounts of cake, &c.

Protein nitrogen must be given in sufficient quantity to correspond with the amounts in milk and fæces. Otherwise, even in presence of an excess of amides, nitrogen will be withdrawn from the body; in absence of amides, a further amount of protein nitrogen would be necessary for the production of urine. The economising effect of amides is, it is suggested, to supply material for the kidneys, which can only work properly when producing urea.

The results would seem to indicate, further, that cows require no nitrogen for maintenance. It is probable, however, that a small amount of nitrogen, a few grams per day, is necessary.

Notwithstanding the, sometimes considerable, amounts of nitrogen as nitrates supplied in the food, no trace of nitrates could ever be detected in the excrementitious matters. Experiments in which nitrates were added to the contents of the large intestine showed that in three days the whole of the nitrate was lost as free nitrogen and some of the original nitrogen as well. In the case of the small intestine, a considerable portion of nitrate was denitrified in a week.

N. H. J. M.

Temperature-coefficient of the Velocity of Nerve Conduction. Charles D. Snyder (*Amer. J. Physiol.*, 1908, **22**, 179—201).—The temperature-coefficient of the velocity of conduction in frog's sciatic nerves lies for the most part between 2 and 3.

Exceptions to this rule are assumed to be due to differences in the chemical time reaction of the conducting substances in the nerve. The meaning of the results is discussed at length, but the most important conclusion reached is that nerve conduction cannot be a purely physical phenomenon. W. D. H.

The Partition of Lecithin in the Animal Organism. Joseph Nerking (*Biochem. Zeitsch.*, 1908, **10**, 193—203).—The whole animal, or its organs, was passed through a sausage machine, extracted with hot alcohol, and then with chloroform or ether. The residue of the extract was incinerated, and, from the phosphoric acid in the ash, the amount of lecithin was calculated. In two rabbits, the total yield was 0·36% and 0·4% of the body-weight respectively. In a hedgehog, the percentage reached 0·8. In other cases, the individual organs were examined, and the results are given in tables. The large percentage of lecithin in the hedgehog was again noted, especially in bone marrow and suprarenals; this is possibly related to the comparative immunity against snake-bite this animal possesses.

W. D. H.

Influence of Salts and Non-electrolytes on the Heart. Stanley R. Benedict (*Amer. J. Physiol.*, 1908, **22**, 16—31).—Experiments on strips of the turtle's ventricle show that certain substances alter its irritability without inciting rhythmical contractions. The sodium chloride latent period represents the time necessary to reach a condition of tonus suited to rhythmic activity; it is not caused by lack of calcium ions or of oxygen. The sodium chloride arrest is attributed to loss of irritability and not to asphyxiation. Langendorff's hypothesis that the products of activity act as stimuli to rhythmic action is regarded as probable. Excess of oxygen and of diffusible calcium compounds do not increase favourable oxidation as Martin considers. The anion probably plays an active rôle in the action of salt solutions on heart tissue, but under certain conditions non-electrolytes (sugars) may induce a series of beats.

W. D. H.

The Extractives of Muscular Tissue. X. R. KRIMBERG (*Zeitsch. physiol. Chem.*, 1908, **55**, 466—480).—The main result of these investigations is to show that the base discovered by Gulewitsch and Krimberg, and called by them carnitine, is identical with the base described by Kutscher under the name of novaine.

Meat-extract solution was treated with tannic acid, and the filtrate, after separation of tannic acid, &c., made alkaline with lead hydroxide and evaporated to a small bulk; crystals separated, and the mother liquor was then treated with silver nitrate and barium hydroxide. From the precipitate, a base was obtained, m. p. 239—240°, whereas, according to Gulewitsch, carnosine has m. p. 241—245°. This is apparently identical with Kutscher's ignotine.

From the filtrate from the silver nitrate and barium hydroxide precipitation, a mixture of bases was isolated by means of phosphotungstic acid and mercuric chloride precipitations. From this mixture, the oblitine was separated by taking advantage of the relatively small solubility of the platinichloride; the other bases were separated by fractional precipitation with gold chloride. The greater part consisted of a base agreeing in properties with carnitine and with the base described as novaine. In addition, small quantities of another base were obtained from the last fraction; the composition of this corresponded with the formula $C_6H_{14}O_2N_2$, but it was not identical with lysine. S. B. S.

Formation of Lactic Acid and Carbon Dioxide in Muscle. P. W. LATHAM (*Bio-Chem. J.*, 1908, **3**, 193—206).—Theoretical views as to the way in which lactic acid and carbon dioxide may originate from the protein of muscle during the processes of contraction and rigor mortis. W. D. H.

Chemical Investigations on the Teeth. TH. GASSMANN (*Zeitsch. physiol. Chem.*, 1908, **55**, 455—465).—The inorganic constituents and loss on destruction of organic matter were estimated. The loss on ignition varied in the different kinds of teeth investigated between 18·33% and 25·99%; the calcium between 27·23% and 31·65%. The greater the former number the smaller the latter. No fluorine could be detected. S. B. S.

The Cleavage Products of the Egg-shell of Scyllium stellare. FRITZ PREGL (*Zeitsch. physiol. Chem.*, 1908, **56**, 1—10).—One hundred parts of the dry and ash-free organic substance of the egg-shell of this dogfish yield glycine, 2·6; alanine, 3·2; leucine and *iso*leucine, 5·8; proline, 4·4; phenylalanine, 3 3; aspartic acid, 2·3; glutamic acid, 7·2; tyrosine, 10·6; lysine, 3·7; arginine, 3·2; histidine, 1·7; tryptophan, present, and cystine, questionable. These numbers are compared in a table with the results obtained from the shells of *Testudo graeca*, the *membrana testacea* of the hen's egg, with keratin, and with koilin. The figures are very different in each case; the high percentage of tyrosine in the present analysis is striking. W. D. H.

Elementary Analysis and Distribution of Nitrogen in Various Egg-shells. Hans Buchtala (*Zeitsch. physiol. Chem.*, 1908, **56**, 11—17).—The following table contrasts the elementary composition of the egg-shells or membranes examined in the following animals:

	Scyllium stellare.	*Pristiurus melanostomis.*	*Scyllium canicula.*	*Scyllium catulus.*	Membrana testacea of hen.	*Coluber natrix.*
C	53·92	51·45	53·64	51·50	48·78	54·68
H	7·33	6·61	6·49	6·51	6·64	7·24
N	15·08	14·33	14·23	15·34	16·43	16·37
S	1·44	1·52	1·33	0·88	4·20	0

The following table gives the distribution of nitrogen (Hausmann's method); the figures not in brackets give the percentage of nitrogen in the material; those in brackets, the percentage in relation to total nitrogen:

	Ammonia *N*.	Melanin *N*.	Mono-amino *N*.	Di-amino *N*.
Scyllium stellare	0·7 (5·09)	0·08 (0·56)	10 96 (79·66)	2·17 (15·8)
Pristiurus mel..........	0·75 (5·13)	0·02 (0·14)	9·70 (66·45)	4·2 (28·8)
Scyllium canic..........	0·64 (4·49)	0·04 (0·24)	9·21 (64·19)	4·4 (30·75)
Memb. testacea	0·89 (6.6)	0·03 (0·21)	9·81 (72·7)	2·77 (20·5)

W. D. H.

The Relations between Lipoid Liquefaction and Cytolysis. Erich von Knaffl-Lenz (*Pflüger's Archiv*, 1908, **123**, 279—293).—The experiments were carried out with sea-urchin eggs (*Strongylocentrotus purpuratus*). They were placed in sea-water to which had been added various substances, such as the ordinary organic solvents, fatty acids, chloral hydrate, bile salts, &c., and then re-immersed in ordinary sea-water and examined under the microscope to determine whether fertilisation, membrane formation, or cytolysis had taken place. The results obtained lead to the conclusion that the essential constituent of a cell-membrane is not a substance of a fatty nature; that the protoplasm is rich in lipoids, and is an emulsion of these substances with proteins; that physical and chemical treatment of the egg, which causes liquefaction of lipoids, causes also cytolysis; that the egg-protein can swell or be dissolved only after a change in the state of aggregation of the fats, and that cytolysis is brought about by the liquefaction of the lipoid and subsequent imbibition of water by, or solution of, the protein. All reagents which can liquefy the lipoids and cause cytolysis of the egg can, by short action and suitable concentration, lead to the formation of membranes (fertilisation membranes). The results thus confirm Loeb's hypothesis that membrane formation is due to lipoid liquefaction. S. B. S.

Excess of Chlorides in Lymph. Anton J. Carlson, J. R. Greer, and A. B. Luckhardt (*Amer. J. Physiol.*, 1908, **22**, 91—103).—Lymph contains more chlorides than serum; the osmotic pressure of the neck lymph of the dog is higher than that of the serum, but anæsthesia produced by ether or by chloroform reverses this osmotic relation. The excess of chlorides is more than sufficient to account for the difference, and it renders filtration and transudation theories of lymph-formation untenable. The explanation of the excess is to be sought in the relation of the lymph to the tissues rather than in the relation of the lymph to the blood. W. D. H.

Lymphagogue Action of Lymph. Anton J. Carlson, J. R. Greer, and F. C. Becht (*Amer. J. Physiol.*, 1908, 22, 104—115).—Injection of lymph intravenously increases the flow of lymph from the thoracic duct. There is also an increase from the neck lymphatics, but the experimental evidence of this is not so clear. Among the views advanced to explain this, the hypothesis is put forward that a lymph-forming hormone is produced in the tissues. The formation of lymphatic lymph and tissue lymph do not always run parallel; thus activity of the salivary glands and pancreas do not always increase the lymph flow from those organs. W. D. H.

Comparative Investigations on the Elimination of Iodine after Administration of Potassium Iodide and Saiodin. Emil Abderhalden and Karl Kautzsch (*Chem. Zentr.*, 1908, i, 874; from *Zeitsch. exper. Path. Ther.*, 1907, 4, 716—719. Compare Basch, this vol., ii, 521).—Saiodin [the calcium salt of iodobehenic acid, $(C_{22}H_{42}O_2I)_2Ca$)] does not undergo scission after treatment either with steapsin, gastric juice, or pancreatic and gastric juices. After administration of the drug, alkali iodides were sought for in the fæces to determine whether such substances had been excreted by the intestine. They were not found, but the iodine, after full absorption of the saiodin, can be detected in the urine. The rate of excretion, however, is very much retarded when compared with that which follows the administration of potassium iodide. S. B. S.

Excretion of Bromides by the Kidney. Worth Hale and Casriel Fishman (*Amer. J. Physiol.*, 1908, 22, 32—42).—After a single dose, the excretion of bromides is much delayed, but the delay is less after successive doses. Iodides are excreted more rapidly. The excretion of calcium bromide and sodium bromide occurs at the same rate. The amount of diuresis holds no absolute relation to the amount of bromide excreted. The observations were made on man.

W. D. H.

The Elimination of Alanine by the Urine. Theodor Brugsch and Rahel Hirsch (*Chem. Zentr.*, 1908, i, 874; from *Zeitsch. exper. Path. Ther.*, 1907, 4, 947—948).—The authors maintain the correctness of their statement, despite Oppenheimer's adverse criticism (Abstr., 1907, ii, 900), that the assimilation limits of *dl*-alanine during starvation are far below the normal. S. B. S.

The Elimination of Conjugated Glycuronic Acid in the Bile. Manfred Bial (*Chem. Zentr.*, 1908, i, 1076; from *Zentr. Physiol.*, 1908, 21, 751—756).—The separation of conjugated glycuronates by means of the bile constitutes a specific secretion, and, under certain conditions, considerable quantities of paired glycuronates are eliminated in this way instead of by the urine. S. B. S.

Origin of Uric Acid and its Relation to Digestion. Theodor Brugsch and Alfred Schittenhelm (*Chem. Zentr.*, 1908, i, 873; from *Zeitsch. exper. Path. Ther.*, 1907, 4, 761—768).—The authors controvert Hirschstein's view (*Arch. expt. Path. Pharm.*, 1907, **57**, 229), according to which at least 70% of the uric acid excreted is due to digestion processes, and therefore appears in the urine after a purine-free diet. They hold rather that the principal part of the uric acid and purine compounds is due to destruction in the organism resulting from the ordinary processes of life. S. B. S.

Glycogen in Mouse Tumours. M. Haaland (*J. Path. Bact.*, 1908, **12**, 439).—There was found to be no relation between the amount of glycogen and the rate of growth in mouse tumours as was stated to be the case by Brault. W. D. H.

Influence of Cold and Exercise on Sugar Excretion in Phloridzin Glycosuria. Graham Lusk (*Amer. J. Physiol.*, 1908, **22**, 163—173).—Lüthje states that in pancreatic diabetes, external cold raises the excretion of sugar; this conclusion is doubtful, and has been criticised previously by others. In phloridzin glycosuria, the dextrose : nitrogen ratio is unchanged by feeding on fat, by the application of cold, or by mechanical work. All this proves that sugar is derived from protein and not from fat. Misstatements regarding the magnitude of the dextrose : nitrogen ratio made by others are corrected. W. D. H.

Production of Sugar from Glutamic Acid Ingested in Phloridzin Glycosuria. Graham Lusk (*Amer. J. Physiol.*, 1908, **22**, 174—178).—Subcutaneous injection of glutamic acid in phloridzin glycosuria (in a dog) raises the output of sugar. The results, which are stated in the form of tables, support the author's previously expressed views on carbohydrate metabolism. W. D. H.

Effect of Potassium Iodide on Ptyalin. C. H. Neilson and O. P. Terry (*Amer. J. Physiol.*, 1908, **22**, 43—47).—The addition of small quantities of potassium iodide to saliva increases the amount of maltose formed. When the drug is given by the mouth and the saliva collected, the secretion has its amylolytic power increased, except in a few patients in whom, for some reason, no potassium iodide appeared in the saliva. W. D. H.

Action of Lactic Acid on the Isolated and Surviving Heart of Mammals. E. Louis Backman (*Chem. Zentr.*, 1908, i, 1076; from *Skand. Arch. Physiol.*, 1908, **20**, 162—196).—The action was investigated by means of the method of Langendorff and Locke with Göthlin's solution (0·63% NaCl, 0·025% $CaCl_2$, 0·05% KCl, and 30% $NaHClO_3$) as perfusion medium. In addition to a general vasodilatation, two special actions were noticed, namely, a muscular paralysis with low concentration, and a stimulating action on the motor ganglia of the heart with more concentrated solutions (0·25—0·5% solutions); they confirm Ranke's hypothesis that lactic acid is a cause of peripheral fatigue. S. B. S.

Action of Digitalis and Strophanthus on the Circulation. Carl Tigerstedt (*Chem. Zentr.*, 1908, i, 1077; from *Skand. Arch. Physiol.*, 1908, **20**, 115—167).—Measurements of blood pressure and volume lead to the conclusion that the increased pressure produced by digitalis and strophanthus is mainly due to contraction of the vessels. No distinct difference could be detected between the behaviour of digitalis and strophanthus. S. B. S.

The Behaviour of Salicin in the Normal and Diabetic Organism. KAORU OMI (*Biochem. Zeitsch.*, 1908, 10, 258—263).—The alimentary canal contains no ferments which act on salicin, but the liver and kidney of herbivora (rabbit, sheep, ox, pig) contain an emulsin which can be demonstrated by the use of extracts of those organs. In carnivora and man, this action is either slight or absent. In dogs, however, after extirpation of the pancreas, the emulsin action occurs in liver extracts. W. D. H.

Excretion of Ethereal Sulphates after giving Salicin to Normal and Diabetic Dogs. CHASABURO KUSUMOTO (*Biochem. Zeitsch.*, 1908, 10, 264—274).—In herbivora (rabbits), the administration of salicin by the mouth or under the skin causes the excretion of salicylic acid and an increase in the ethereal sulphates of the urine. In normal dogs, this is more marked, especially when the drug is given by the mouth. At least 10% of the amount given is acted on by the emulsin of the tissues. In dogs deprived of the pancreas, this is usually increased. W. D. H.

Atoxyl and Aniline Poisoning. FERDINAND BLUMENTHAL and FRIEDRICH HERSCHMANN (*Biochem. Zeitsch.*, 1908, 10, 240—244).—The toxic effects of atoxyl have been attributed by some to arsenic and by others to aniline poisoning. The latter view is rendered unlikely by the discovery that neither aniline nor *p*-aminophenolsulphonic acid can be detected in the urine after administration of atoxyl. The drug is apparently excreted in the form of a closely-allied derivative still containing both arsenic and the amino-group.
G. B.

Chemistry of Vegetable Physiology and Agriculture.

Reservoir for Storing Aseptic Liquids. LOUIS GAUCHER (*Ann. Chim. anal.*, 1908, 13, 212—214).—The reservoir (flask, or Woolf's bottle, with a syphon) is made entirely of glass without corks, and is so arranged that no air can enter without first having been filtered through a layer of cotton-wool. For details of construction, the illustrations in the original should be consulted. L. DE K.

Behaviour of Algæ to Salts at Certain Concentrations. T. TAKEUCHI (*Bull. Coll. Agr. Tōkyō*, 1908, 7, 623—629).—Solutions of potassium nitrate, chloride and sulphate, mono- and di-potassium phosphate, the corresponding salts of sodium, and calcium chloride and nitrate were employed in equal molecular and equivalent concentrations, the standard solution being a 1/10 gram-mol. solution of potassium nitrate. Threads of *Spirogyra nitida* were kept in the solutions at 8—20°.

Potassium nitrate (1·01%) killed all the cells in eight days. In the corresponding calcium nitrate solution, the cells remained healthy much longer, and even in 2·46% solutions most cells seemed normal after two weeks.

Taken altogether, the results show that calcium salts, at moderate concentrations, are less injurious than equivalent amounts of sodium and potassium salts. The injurious action of magnesium salts can only be completely overcome by calcium and not by sodium or potassium salts. N. H. J. M.

Galvanotropism in Bacteria. JAMES FRANCIS ABBOTT and ANDREW CREAMORE LIFE (*Amer. J. Physiol.*, 1908, **22**, 202—206).—Termo, subtilis, and typhus bacilli in a neutral medium form definite gatherings at the cathode, an extremely weak current being used. If grown in acid media, this response is intensified. In alkaline media, they gather at the anode. Bacteria killed by heat show no response. W. D. H.

The Decomposition of Amino-acids by Bacillus proteus vulgaris. PAUL NAWIASKY (*Arch. Hygiene*, 1908, **66**, 209—243).—The decomposition products obtained by the action of *B. proteus vulgaris* on various amino-acids were investigated, and in certain cases determined quantitatively. Not all amino-acids are readily attacked by the bacillus. The following acids, which were investigated, are arranged in order according to the readiness with which they are attacked, the most easily decomposable being placed first; aspartic acid, leucine, aminovaleric acid, phenylalanine, tyrosine, arginine, creatine, glycine, alanine. In the cases of *l*-proline and glutamic acid, the decomposition is due entirely to respiration.

Asparagine is readily decomposed into succinic and acetic acids, ammonia, and carbon dioxide. This decomposition can also be brought about by dead bacteria, although slowly and incompletely; the rate of decomposition is proportional to the acting mass of the bacteria.

Aminovaleric acid yields as a decomposition product, butyric acid, and leucine yields amyl alcohol. The decomposition of the latter may be represented by the following equations:

$$CHMe_2\cdot CH_2\cdot CH(NH_2)\cdot CO_2H + H_2O = CHMe_2\cdot CH_2\cdot CH(OH)\cdot CO_2H + NH_3;$$

$$CHMe_2\cdot CH_2\cdot CH(OH)\cdot CO_2H = CHMe_2\cdot CH_2\cdot CH_2\cdot CO_2H + CHMe_2\cdot CH_2\cdot CO\cdot CO_2H;$$

$$CHMe_2\cdot CH_2\cdot CO\cdot CO_2H = CHMe_2\cdot CH_2\cdot CHO + CO_2;\ 2CHMe_2\cdot CH_2\cdot CHO + H_2O = CHMe_2\cdot CH_2\cdot CH_2\cdot OH + CHMe_2\cdot CH_2\cdot CO_2H.$$

S. B. S.

Nitrification in Black Soils. Influence of Different Factors on Nitrification and the Amounts of Nitrates in the Soil at Different Times of the Year. W. SASANOFF (*J. exper. Landw.*, 1907, **8**, 35—38).—Whilst the black soils of Russia are greatly benefited by superphosphate, sodium nitrate is only required in very small quantities. It is shown that in the Spring the soil may contain very small amounts of nitrates; in such cases, applications of 8 to 30 kilos. of sodium nitrate, not sown broadcast, but drill-sown below the seed, enable the plants to make a start. Later on, nitrification is sufficiently rapid for the requirements of the crop.

In order to promote the accumulation of nitrates in the soil, it is shown that suitable tillage, at the proper time, is of great importance. Farmyard manure was found to be of little, if any, use, whilst undecomposed organic matter, such as straw, hindered nitrification at first. Green manuring with leguminous and other crops has no appreciable effect on nitrification, and has the disadvantage that the growing crop disperses the moisture of the soil and takes up the nitrates. N. H. J. M.

Inoculation Experiments with Azotobacter. Jacob C. Lipman and Percy E. Brown (*28th Ann. Rep. New Jersey State Agric. Exper. Stat.*, 1906—1907, 141—170).—Successive gramineous crops (oats, maize, rye, maize, rye, and maize) were grown in sixty large cylinders containing sandy loam both without manure and with calcium carbonate, basic slag, farmyard manure, calcium carbonate + farmyard manure, and the same as the last with basic slag in addition. One series was without inoculation, and the others with *Azotobacter Vinelandii* and *A. Beijerincki* respectively. The soils were manured and inoculated the first time about a year before the first seeds were sown, and the inoculation was repeated later on. The rye crops (green) were dug in each time.

The results obtained with the first crop showed on the whole greater yields of dry matter and nitrogen without than with inoculation. An examination of the soil then showed that, whilst *Azotobacter Beijerincki* was abundant and vigorous in the pots manured with calcium carbonate and dung, most of the bacteria had either become feeble or failed altogether in the other pots. The soil conditions would seem to be more unfavourable for *A. Vinelandii*, which is much less abundant than *A. Beijerincki* in the soils of New Brunswick (N. J.), than for *A. Beijerincki*. The second crop (maize) gave somewhat similar results as the first, whilst the third crop (rye) gave greater yields in the inoculated than in the uninoculated pots. Taking the whole series, however, the final results showed no benefit from inoculation, whilst, as regards the soils themselves, there was sometimes a gain and sometimes a loss of nitrogen irrespective of inoculation.

Treatment with carbon disulphide before the fifth crop had no immediate uniform effect, but it seemed to benefit the sixth crop.
N. H. J. M.

Formation and Diappearance of Acetaldehyde under the Influence of Yeasts. Auguste Trillat and Sauton (*Compt. rend.*, 1908, **146**, 996—999).—When baker's pressed yeast is vigorously stirred with dilute alcohol for several hours with free access of oxygen, acetaldehyde can be separated by distillation (1—2·5% of the alcohol employed). The action is primarily a vital one. At the same time, acetaldehyde disappears fairly rapidly when added to yeast in dilute alcohol. G. B.

Effect of Temperature on the Respiration of Apples. FRED. W. MORSE (*J. Amer. Chem. Soc.*, 1908, **30**, 876—881).—Apples undergo chemical changes twice or three times as fast with a rise of temperature of 10° between 0° and 20°. Respiration and, consequently, destruction of cell tissues goes on at low temperatures, and the keeping quality of apples is therefore limited even in cold storage. N. H. J. M.

The Liberation of Carbon Dioxide by Dead Parts of Plants. A. J. NABOKICH (*Ber. deut. bot. Ges.*, 1908, **26a**, 324—332).—In a high vacuum, seeds, seedlings, and various other plant objects gradually give off, after death, not inconsiderable quantities of carbon dioxide. This liberation of carbon dioxide is independent of ferments or bacteria, and also of the manner in which the plant has been killed (whether by freezing, heating, boiling acids, or superheated steam).

Aerobic cultures of fungi set free ammonia, which is retained by the carbon dioxide of respiration as ammonium carbonate, and is slowly set free in anærobic life by the organic acids formed under such conditions; this slow liberation of carbon dioxide simulates intramolecular respiration. G. B.

Influence of Didymium [and Glucinum] on Plants. C. KANOMATA (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 637—640).—Barley was grown in pots containing 10 kilograms of loamy soil, manured with minerals and potassium nitrate. Three pots received, in addition, 0·01, 0·1, and 0·5 gram of "didymium" nitrate (the unseparated salts of praseodymium and neodymium) previously neutralised with sodium hydroxide. The plants grown with 0·01 gram of "didymium" nitrate showed a considerable increase in total weight (17·5%), and in the weight (42·4%) and number of ears, as compared with the control pot, whilst the larger applications diminished the yield. A similar stimulating effect was observed when neutralised "didymium" nitrate was applied to mustard, *Raphanus sativus radicula*, and tobacco at the rate of 1 per million of soil.

The increase in the three last experiments amounted to 13·7% with mustard, 27·0% with *Raphanus*, and 32·1% with tobacco.

Glucinum nitrate neutralised with sodium hydroxide, when applied to oats at the rate of 10 per million of soil, had no decided effect (the yield of fresh substance was 4·5% higher than in the control pot), whilst larger amounts (100 and 500 per million) reduced the yield. N. H. J. M.

Oxydases in India-rubber. DAVID SPENCE (*Bio.-Chem. J.*, 1908, **3**, 165—181).—The observations recorded show that the darkening of raw rubber is due to an oxydase associated with the protein or so-called insoluble constituent of the rubber. Whether it is responsible for other changes which occur on keeping (decomposition, &c.), further work will determine. The ferment is probably reversible in its action, and it is suggested that the function of caoutchouc in the latex is not merely protective to the plant, and that the latex does not merely serve as a reserve store for water; caoutchouc itself is probably a reserve food-stuff for the plant. W. D. H.

Toxic Substance Excreted by the Roots of Plants. F. Fletcher (*Mem. Dept. Agric. India; Bot. Ser.*, 1908, 2, No. 3).—Plot experiments were made in which sorghum, cajanus, cotton, and sesamum were grown next to each of the others and next to fallow. Taking the yield of the outside rows next to fallow as 100, the differences in the middle rows of each plot and of the outside rows next to the plots bearing the other crops are assumed to indicate depression of yield due to a toxic substance secreted by its own roots and by the roots of the other plants. A further experiment is described in which cotton and sorghum were grown in alternate rows two feet apart. The results show great regularity, and the conclusions are drawn (1) that all plants excrete a substance which is toxic to themselves and to other plants; (2) that different crops excrete varying amounts of the substance, and (3) that the sensitiveness of different crops to the same amount of the poison varies.

Water culture experiments were made with the above plants and with wheat and grain in addition, each plant being grown in water previously used for the same plant and for each of the others. Gram water was found to be the most toxic, then sesamum, wheat, cotton, cajanus, and sorghum water. The strength of the solution is, of course, arbitrary; the regularity of the results indicates, however, that the toxic substance is the same in all plants.

As regards the amount of toxic substance produced, the solution in which ten cotton plants (weighing 0·4 gram when air dry) were grown gave with potassium sulphate a precipitate weighing, when dry, 0·21 gram. The substance seems to be an alkaloid (the base itself, not a salt) which differs from the commoner alkaloids in being sparingly soluble. Its toxic effect is corrected by tannic acid, and it is usual to manure spice gardens and rice fields with leaves containing tannic acid. N. H. J. M.

Composition of Rice Straw. T. Takeuchi (*Bull. Coll. Agr. Tōkyō*, 1908, 7, 619—621).—Analyses of two samples of straw (1) from a favourable harvest and (2) from a poor harvest give the following results:

	Dry matter.	*N.*	Crude fat.	Crude fibre.	Dextrose.	Sucrose.	Starch, hemicelluloses.	Pentosans.	Crude ash.	SiO_2.
1.	87·69	0·97	1·36	31·16	2·25	0·79	14·86	14·28	11·42	5·39
2.	90·15	1·48	1·65	28·72	3·28	0·96	18·75	16·55	12·35	6·13

N. H. J. M.

Continuous Growth of Peas on the Same Soil. Shigehiro Suzuki (*Bull. Coll. Agr. Tōkyō*, 1908, 7, 575—577).—Experiments with peas grown for four years in succession in the same humous loam with mineral and nitrogenous manures failed to give any indications of pea-sickness. The yield tended rather to increase. Very few nodules were found on the roots of the plants.

Heating the soil in steam at 100° for four hours on three consecutive days had practically no effect on the yield.

The conclusion is drawn that pea- and clover-sickness may be sometimes due to deficiency of phosphoric acid in the soil, and sometimes to want of potash, as suggested by Gedroiz (*J. exper. Landw.*, 1908, **8**, 61). N. H. J. M.

Behaviour of Onions to Stimulants. I. NAMBA (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 635—636).—Addition of 0·1 gram of manganese sulphate to 8 kilograms of soil, corresponding with 22 kilos. per hectare, increased the yield of onions (leaves, bulbs, and roots) 59·2%, whilst 0·2 gram gave an increase of 34·2%.

Sodium fluoride applied at the rate of 2·2 kilos. per hectare (0·01 gram in 8 kilos. of soil) increased the yield 80·2%. With 0·05 and 0·2 gram, the increase was reduced to 31·5 and 7·8% respectively. N. H. J. M.

Cultivation of Sugar-Beet. Potassium Manuring of Beet Soils. E. SAILLARD (*Bied. Zentr.*, 1908, **37**, 426—427; from *J. d'Agric. Prat.*, 1907, i, 454).—Determinations of sugar, potassium, and sodium in sugar-beet from all parts of France where they are grown showed that with diminished percentages of sugar there is a regular increase in the sodium expressed as percentage in the portion of the ash soluble in hydrochloric acid. The potassium was found to vary very slightly. Roots containing 16—17% of sugar contained 3·6% K_2O and 5% Na_2O in the ash (excluding insoluble portion), whilst roots with 8—11% of sugar contained 38% K_2O and 17·5% Na_2O in the ash. The paralysing action of sodium is shown by results obtained near the sea, where it is impossible to grow roots with high percentages of sugar. In manuring sugar-beet, sodium nitrate should be employed in moderation. The following manures are recommended: superphosphate, 300—500 kilos.; potassium (as sulphate, chloride, or kainite), 75—90 kilos.; nitrogen (as sodium nitrate), 25—40 kilos. per hectare, and the rest of the nitrogen in an organic form, as farmyard manure. N. H. J. M.

Experiments with Different Varieties and on the Storage of Mangolds. BOUWE SJOLLEMA and C. K. VAN DAALEN (*Verslagen Landbouwkund. Onderzoek Rijkslandbouwproefstat.*, 1907, No 2, 31—49. Compare Miller, Abstr., 1900, ii, 430; *J. Roy. Agric. Soc.*, 1902, **63**, 135).—Experiments were made with fourteen varieties of mangolds, manured with superphosphate only and grown in rows 50 cm. apart, the distances in the rows being 40 and 50 cm. respectively. Determinations of total weight, dry matter, and sugar were made in October, when the crop was taken up, and also in the clamped roots in January and in April.

The weight of the roots was greatest, as well as the average yield of sugar, in the case of the roots grown 40 cm. apart.

In January the average loss in weight was 2%, and in the case of the varieties containing the lower percentages of sugar, about 1·5% of sucrose was converted into reducing sugar. Inversion was slower in the case of the roots containing high amounts of sugar.

In April there was a further loss of about 1% in the weight of the roots, and the amount of reducing sugar increased to 2—3%, although in some cases it remained below 1%.

The average loss of dry matter from October to April was 9·35%; the greatest loss was 20·6%, and in two cases there was a slight gain. The loss of sugar amounted in some cases to more than 10%.

N. H. J. M.

Manurial Experiments on Mangolds with Calcium Cyanamide and Sodium Nitrate. S. Klöppel (*Bied. Zentr.*, 1908, **37**, 386—391; from *Fühling's Landw. Zeit.*, 1907, **56**, 535).—Field experiments with six varieties of mangolds resulted, in each case, in higher yields of dry matter and sugar when manured with calcium cyanamide than with sodium nitrate. The results are partly attributed to frequent rain and consequent washing of sodium nitrate into the subsoil.

N. H. J. M.

Occurrence of Cyanogenetic Glucosides in Feeding-stuffs. Thomas A. Henry and Samuel J. M. Auld (*J. Soc. Chem. Ind.*, 1908, **27**, 428—433).—Since it has been found that many plants which are used as feeding-stuffs contain cyanogenetic glucosides (Dunstan and Henry, Abstr., 1901, i, 39, 647; 1902, ii, 578; 1904, ii, 71; 1907, i, 1063; 1907, ii, 983; Dunstan, Henry, and Auld, Abstr., 1906, ii, 794, 795; 1907, ii, 572), it has been considered desirable to record the amounts of hydrogen cyanide yielded under different conditions and to describe the methods employed in their estimation. In addition to giving this information, the present paper introduces certain new facts.

It has been found that when these plants are ground and macerated with water, the amount of hydrogen cyanide developed does not correspond with the quantity which would be produced by the total decomposition of the glucoside present. This is due to the inhibiting action exerted by the dextrose produced during the hydrolysis.

Two samples of linseed cake which were examined furnished 0·032 and 0·045% of hydrogen cyanide. It has been observed that some white varieties of the seeds of *Phaseolus lunatus* yield hydrogen cyanide. Traces were obtained from certain French haricots, from 0·026 to 0·068% from some Ceylon varieties, and 0·002% from "butter beans." In the case of the bitter cassava, the green branches did not yield any hydrogen cyanide, the stem furnished 0·007%, and the whole tubers, 0·013%. The stem of the sweet cassava gave 0·005%, the whole tubers, 0·014%, the rind of the tubers, 0·040%, and the inner portion, 0·007%.

E. G.

Effects of Feeding with Maize. Certain Properties of Zein. I. Silvestro Baglioni (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 609—617).—The author discusses the work of Paladino-Blandini

(*Arch. farm. sper. ecc.*, 1907, **6**, 57), Bezzola (*Zeitsch. Hygiene*, 1907, **56**, 75), Scheunert and Grimmer (Abstr., 1906, ii, 239), and Szumowski (Abstr., 1902, ii, 674) on zein or maize as a food-stuff, and on its action in causing the disease termed pellagra.

Zein yields relatively large proportions of phenylalanine and tyrosine when decomposed, and free phenolic compounds can often be detected in maize which has been attacked by moulds or other micro-organisms. If zein, suspended in water, is treated with potassium hydroxide and copper sulphate solutions, the violet biuret coloration only appears after a few minutes; if, however, the zein is first treated for a short time with potassium hydroxide solution, it yields the coloration immediately the copper sulphate solution is added. The delay in the appearance of the reaction is occasioned by the insoluble zein requiring to be degraded into simpler proteoses by the action of the potassium hydroxide (compare Dennstedt and Hassler, Abstr., 1906, i, 916).

The digestion of zein by infusions of the pancreas or intestinal mucus of the dog or hog, or by commercial pepsin preparations, proceeds slowly and with difficulty. In no case did the zein undergo complete solution, possibly owing to the accumulation of the products of digestion, and to the weakening of enzymatic activity. Experiments on the digestion of zein by means of extracts of germinating maize corns have not, as yet, met with success.

Guinea-pigs fed on a paste of maize or wheat flour and water exhibit all the symptoms of general decline, and die in a period varying from a few days to a month. If part or all of the maize or wheat flour is replaced by zein, the animals exhibit symptoms of poisoning somewhat similar to those observed in cases of phenolic intoxication. T. H. P.

New Apparatus for Showing the Ammonia-condensation Power of Soils. GEORG RÖSING (*Chem. Zentr.*, 1908, i, 1323; from *Zeitsch. landw. Vers-Wesen Oesterr.*, 1908, **11**, 123—127).—A modification of the apparatus described by Wohltmann and Schneider (Abstr., 1905, ii, 649), whereby the volume of the gas before and after the adsorption may be arrived at, and thus the calculation of the amount by weight rendered possible. J. V. E.

Physical and Chemical Processes in the Production of Soils. PAUL ROHLAND (*Bied. Zentr.*, 1908, **37**, 289—291; from *Landw. Jahrb.*, 1907, **36**, 473).—The diffusion of water and plant nutrients in soils is intimately connected with the presence of colloids, mainly silicic acid and aluminium hydroxide, produced by the interaction of felspar, water, and carbon dioxide. As regards chemical actions, the replacement of basic constituents in double silicates by bases dissolved in the soil water is of great importance, as, for instance, when sodium applied in a manure liberates potassium from insoluble compounds present in the soil.

The processes of adsorption depend on the different concentration of those portions of the soil water which are in contact with the surface of substances such as double silicates, clay, humus, and ferric hydroxide, &c., the more complex substances, such as phosphates, being more readily adsorbed than simpler compounds like potassium chloride. Another factor of importance is the mutual action of salts on solubility. The solubility of calcium sulphate, for instance, is increased in presence of sodium, potassium, and ammonium salts, and more by sodium nitrate than by sodium chloride, so that the availability of superphosphate, in which the particles of phosphates are encased in calcium sulphate, is increased by the presence of the above-mentioned salts. N. H. J. M.

Why are Poor Sandy Soils Often Easily Injured by Liming? H. YOKOYAMA (*Bull. Coll. Agr. Tōkyō*, 1908, 7, 615—617).—Experiments with oats grown in purified quartz sand manured with ammonium nitrate, potassium sulphate, sodium phosphate, and different amounts of limestone and magnesite showed that further addition of lime to sand poor in lime caused a greater depression in yield than in the case of sand rich in lime, and that the ratio $CaO:MgO=5:1$ is less favourable than the ratio $1{\cdot}8:1$. The conclusion is drawn that injury to sandy soils by liming is not due to destruction of bacteria or to lessened assimilability of the phosphoric acid (except when bone-dust or phosphorite are present), but to an unsuitable lime-magnesia ratio. Dolomitic limestone should be employed. N. H. J. M.

Changes of Availability of Nitrogen in Soils. OSCAR LOEW and KEIJIRŌ ASŌ (*Bull. Coll. Agr. Tōkyō*, 1908, 7, 567—574).—A culture solution containing mineral nutrients and glycerol, inoculated with *Bacillus mycoides*, to which peptone and sodium carbonate were added subsequently, gradually developed films, which were distributed through the liquid by shaking. After six weeks, the contents of two flasks which no longer produced films were evaporated down in a vacuum. A gram of soil was added to one portion of the solution, whilst a second portion was boiled for a few minutes before addition of soil. The solution which had been boiled soon developed a luxuriant film of microbes, whilst the solution which had not been boiled remained unchanged for four weeks. The results show that soil bacteria can produce a bacteriolytic enzyme which renders new bacterial growth difficult, and furnishes some explanation why bacterial life does not increase infinitely in organically manured soils.

Gerlach and Vogel's observation that Azotobacter requires calcium was confirmed. In culture solutions containing mannitol and sodium malate respectively, growth failed until small amounts of calcium chloride were added (compare Christensen, this vol., ii, 67).

As regards the chemical process of nitrogen fixation, it is suggested that nitrogen combines with the elements of water, producing ammonium nitrite, the nitrous acid being at once reduced to ammonia. Nitrous acid has been detected in leguminous root nodules. The view that nitrous acid may be produced by oxidation is supported by results obtained by platinum black and alkali (compare Loew, Abstr., 1890, 1051, and Wöhler, Abstr., 1904, ii, 44). N. H. J. M.

Ammonia-soluble Phosphoric Acid of the Soil. GEORGE S. FRAPS (*Amer. Chem. J.*, 1908, **39**, 579—586).—In the course of an investigation on the phosphoric acid of the soil, a study has been made of the phosphoric acid which is extracted by ammonia from a soil which has been previously treated with hydrochloric acid. It has been found that the phosphoric acid so dissolved is partly in organic and partly in inorganic combination, and should therefore not be regarded as being entirely of the nature of "humus-phosphoric acid." E. G.

Pot Culture Experiments, 1906–7. JOHN A. VOELCKER (*J. Roy. Agric. Soc.*, 1907, **68**, 264—266. Compare Abstr., 1905, ii, 754; 1906, ii, 888).—Lithium chloride or sulphate, in very small quantities (0·05 gram Li to 100 of soil) reduced the yield of wheat to 25%, the action being largely due to the stunting of root growth.

Iron sulphate, in similar amount, increased the produce materially, whilst manganese chloride and sulphate, not exceeding 1 cwt. per acre, are also beneficial.

The greater benefit observed in field experiments by the ploughing in of mustard as compared with vetches is shown by experiments in pots to be due to physical conditions of the soil, the vetches producing a light and open condition resulting in a much greater loss of water than is the case with mustard.

Experiments on the application of different amounts of lime and magnesia to soil growing wheat and barley showed that as the lime and magnesia ratio approaches 1 : 1, the wheat grain tends to show greater strength. When the relation of MgO : CaO is increased, the roots become abnormally extensive and fibrous.

With regard to the acid condition produced in Stackyard Fields by the continued application of ammonium salts to a soil deficient in lime, it is shown that the failure of the crop is due to the presence of a poisonous substance soluble in water, or to the growth of some lower forms of vegetation. N. H. J. M.

Manurial Experiments with Sodium Nitrate, Ammonium Salts, and Calcium Cyanamide. PAUL WAGNER, G. HAMANN, and A. MÜNZINGER (*Bied. Zentr.*, 1908, **37**, 366—386; from *Arb. deut. landw.-Ges.*, 1907, No. 129. Compare *ibid.*, No. 80).—The results of experiments with cereals showed that manuring with ammonium salts produced 77% of the amount of grain obtained with corresponding amounts of sodium nitrate, and that 63% and 46% of the nitrogen applied as nitrate and as ammonium salts respectively was recovered. In the case of sugar-beet and mangolds, the amounts of nitrogen recovered were 63% and 43%.

The lower results obtained with ammonium salts as compared with nitrate are attributed to loss as ammonia, and to fixation, both chemical and physical, of some of the ammonia by zeolites. Clay soils retain appreciable amounts of ammonia even after distillation with magnesia. It is suggested that ammonia fixed in this manner escapes nitrification.

Calcium cyanamide has no injurious effect when applied immediately before sowing the seed if employed in normal amounts and evenly distributed; its effect is, however, sometimes increased by applying a week or two before sowing. Soils very rich in humus or deficient in lime should be limed before using calcium cyanamide. Experiments with oats, winter rye, and barley showed that the amounts of nitrogen as cyanamide utilised were 83, 87, and 69 respectively compared with sodium nitrate = 100. In the case of mangolds, the result was less satisfactory, the amount of nitrogen recovered being 56% as compared with sodium nitrate. N. H. J. M.

Manurial Experiments with Calcium Cyanamide. ALBERT STUTZER (*Bied. Zentr.*, 1908, **37**, 422—423; from *Ill. landw. Zeit.*, 1907, **27**, No. 78).—Field experiments, under very unfavourable climatic conditions, on a raw, sandy loam in which oats and barley were manured with ammonium salts, calcium cyanamide ("stickstoffkalk"), and sodium nitrate respectively, in addition to soluble phosphoric acid (50 kilos.) and potash (100 kilos. per hectare). Sodium nitrate gave the highest results, whilst calcium cyanamide gave, on the average, 84·5% of the grain obtained with nitrate. The results obtained with ammonium salts were very variable. N. H. J. M.

Efficacy of Calcium Cyanamide under Different Manuring Conditions. I. NAMBA and C. KANOMATA (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 631—634).—In pot experiments with oats and onions, it was found that rather higher yields were obtained when calcium cyanamide was employed in conjunction with double superphosphate than with disodium phosphate. Similar results were obtained by Inamura (Abstr., 1906, ii, 891) with *Brassica chinensis*.

Further experiments with *Brassica chinensis* and oats, in which bone-dust was used in conjunction with ammonium sulphate and calcium cyanamide respectively, showed that the latter had no depressing effect on the availability of the bone-dust. N. H. J. M.

Action of "Kalkstickstoff," "Stickstoffkalk," and Calcium Nitrate. BOUWE SJOLLEMA and J. C. DE RUYTER DE WILDT (*Verslagen Landbouwkund. Onderzoek. Rijkslandbouwproefstat.*, 1907, No. 2).—Calcium cyanamide reacts with water, forming calcium hydroxide and the compound $Ca(N{:}C{:}NH)_2$, the latter being gradually decomposed by calcium hydroxide and cyanamide into the basic salt, $C(N\cdot CaOH)_2$, which slowly polymerises to dicyanodiamide.

It is shown that the injurious action of calcium cyanamide on germination is not due to lime as stated by Immendorf and Thielebein (Fühling's *Landw. Zeit.*, 1905, **54**, 792), or to the gases produced from calcium carbide and phosphide or to dicyanodiamide, but that it is due to the basic salt already mentioned. On the other hand, dicyanodiamide was found to cause injury to mustard and buckwheat plants, causing the edges of the leaves to become white, and in large amounts to destroy them altogether. Injury to germination by the basic salt and cyanamide would probably not as a rule occur under practical conditions.

The results of manurial experiments, in cylinders, in which oats were manured with sodium nitrate, ammonium sulphate, and calcium nitrate showed that the relative gain in total produce (grain and straw) was as 100 : 91·9 : 115·9. Experiments with calcium cyanamide gave conflicting results. N. H. J. M.

Experiments with Basic Slag-ammonia. BACHMANN (*Bied. Zentr.*, 1908, **37**, 423—424; from Fühling's *Landw. Zeit.*, 1906, **55**, 808).—The manure contains: P_2O_5 (citrate soluble), 7·15; N as ammonia, 6·77, and CaO, 25·22%. When stored for three months there was a loss of 1·54% of nitrogen as ammonia. Experiments with rye, oats, and grass showed that lower results were obtained with the manure than with a mixture of equivalent amounts of basic slag and ammonium sulphate. N. H. J. M.

Depression of Growth by Large Amounts of Calcium. C. KANOMATA (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 597—607).—In sand-culture experiments, the yield of oats was reduced 39% by altering the ratio CaO/MgO from 1/1 to 100/1, whilst in soil there was a decrease of 48% when the ratio was altered from 1/1 to 10/1.

Similar results were obtained with rice, barley, buckwheat, mustard, and onion.

An experiment with buckwheat in which powdered magnesite was added in such quantity to the soil injured containing an excess of calcium carbonate that the ratio CaO/MgO was changed from 100/1 to 100/100, showed a restoration of favourable conditions. It is therefore not the absolute amount of calcium carbonate which is injurious, but its relation to the amount of magnesium present. N. H. J. M.

Gypsum as a Manure. T. TAKEUCHI (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 583—597).—A large number of pot experiments are described in which peas, barley, oats, beans, rice, and spinach were manured with different forms of phosphoric acid and nitrogen without and with addition of gypsum. Experiments were also made on the effect of gypsum in presence of magnesia alba.

It is shown that calcium sulphate is very beneficial when sodium nitrate is employed, or more generally when any alkaline reaction is produced in the soil. In presence of superphosphate or ammonium sulphate, it tends to depress the yield.

Calcium sulphate is also beneficial in the case of soils containing an excess of magnesium, and may be employed with advantage in the case of spinach, for which calcium carbonate is unsuitable. N. H. J. M.

Absorption of Varying Amounts of Lime and Magnesia by Plants. T. TAKEUCHI (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 579—581).—Oats were grown in (1) soil in which by addition of calcium carbonate the ratio CaO : MgO was 10 : 1, and in (2) a control pot containing soil having a ratio of about 1 : 1. The following results were obtained :

	Leaves.				Roots.			
	Fresh weight,* grams.	Crude ash, per cent.	Per cent. in ash.		Dry weight, grams.	Crude ash, per cent.	Per cent. in ash	
			CaO.	MgO.			CaO.	MgO
1.	106·3	11·97	18·82	4·85	4·4	8·17	32·31	8·69
2.	301·0	12·43	10·94	4·42	13·5	9·45	13·22	6·66

* Including the stems.

The greatest height of the plants of the two pots was (1) 92 and (2) 108 cm., and the number of shoots (1) 32 and (2) 42. N. H. J. M.

Agronomical Equivalent of Artificial Magnesium Carbonate. S. Kanamori (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 609—612).—The availability of artificial magnesium carbonate is greater than that of the natural substance, owing to difference in composition and to its more finely-divided condition. The results of pot experiments with oats showed that 0·1—0·6 gram of magnesia alba is agronomically equivalent to 5 grams of magnesite, and that larger amounts (in 2·5 kilos. of sand) reduced the yield. Similar results were obtained with barley. N. H. J. M.

Top-dressing with Magnesium Sulphate. J. N. Zirker (*Bull. Coll. Agr. Tōkyō*, 1908, **7**, 613—614).—Application of magnesium sulphate, at the rate of 10 kilos. per hectare, to half of a plot which had received slaked lime at the rate of 10,000 kilos. per hectare increased the yield of barley 31%. N. H. J. M.

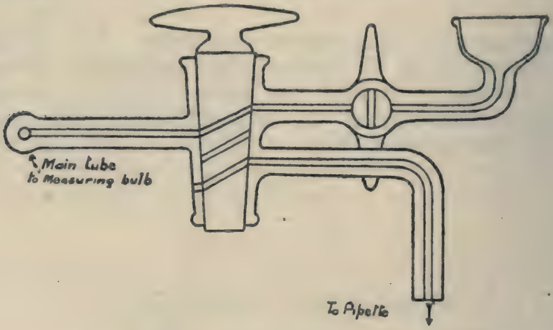
Analytical Chemistry.

Apparatus for Testing Burettes and Pipettes; also Mercury Measuring Tubes. O. von Spindler (*Chem. Zentr.*, 1908, i, 1419—1420; from *Schweiz. Woch. Chem. Pharm.*, 1908, **46**, 145—148). —A modification of the Ostwald pipette. The burette to be tested is placed on the long arm of a U-shaped tube, whilst on the shorter arm is placed a standard graduated pipette. Both arms are fitted with glass stopcocks; a third stopcock at the bottom serves for the purpose of emptying the apparatus, and a fourth one regulates the supply of liquid contained in a reservoir, from which the apparatus is filled. By proper regulation of the stopcock, the burette to be tested is filled with water up to the top mark, whilst the calibrated pipette (moist inside) stands at zero. Any quantity of liquid running from the burette through the U-tube can be read off in the standard pipette. In the case of a mercury measuring tube, it may be arranged so that a given volume of mercury forces the same volume of water into the burette. L. de K.

Circulation Burette. Gustav Muller (*Chem. Zeit.*, 1908, **44**, 532).—An ordinary burette is surmounted by a closed stoppered reservoir which is fused on to a large double bored glass tap in such a manner that a liquid may pass through the smaller bore of the tap to the burette, while at the same time the displaced air passes through the second bore of the tap to the top of the closed reservoir. In this manner, the burette may be re-filled without opening to the atmosphere. To allow the burette to deliver the contained liquid, an additional small hole, communicating with the outside, is bored in the large tap. J. V. E.

New Gas Analysis Apparatus. Raymond Ross and John P. Leather (*J. Soc. Chem. Ind.*, 1908, **27**, 491).—The apparatus consists of a measuring bulb surrounded by a water jacket; it is provided with a three-way tap and connected by flexible tubing with a mercury reservoir and also with an 800 mm. graduated tube. The measuring bulb communicates with eight absorption pipettes by means of a capillary provided with specially designed taps. The construction of these is shown in the diagram.

By raising the mercury reservoir, the measuring bulb and the whole of the connexions are filled with mercury, which is allowed to flow through each tap in turn until the small glass cups are about half filled. The reservoir is then lowered so that the mercury falls to the mark on the measuring bulb. The barometric pressure is now read off in millimetres, including the pressure of aqueous vapour, sufficient water for this purpose being introduced with the mercury. The barometer tube is shut off and the measuring bulb re-filled with mercury, the gas to be analysed being introduced and brought exactly to the mark at atmospheric pressure. To introduce the gas into the required absorption pipette, the mercury reservoir is raised, and the mercury in the capillary connecting tubes driven forward into the cups until the gas just reaches the three-way tap. The small tap is then closed, and the absorbent is driven up until it fills the bore of the tap. The tap is next turned so as to allow the gas to enter the pipette. When the absorption is complete, the process is reversed, the gas being swept through the capillary tube into the measuring bulb by means of the mercury in the cup. The mercury is again brought to the mark in



the measuring bulb, connexion with the millimetre tube having been re-established. The reading, multiplied by 100 and divided by the first (" barometric") reading, gives the percentage absorption.

W. P. S.

Metanil Yellow; its use as a Selective Indicator. Ernest Linder (*J. Soc. Chem. Ind.*, 1908, **27**, 485—488).—Strips of filter paper which have been dipped in a 0·1 solution of metanil yellow (the sodium salt of diphenylamineazo-*m*-benzenesulphonic acid) and then dried, are coloured violet when exposed to gases containing vapours of mineral acids, whilst they are unaffected by sulphur dioxide, chlorine, hydrogen sulphide, or acetic acid. The colour change takes place within two minutes in an atmosphere containing 0·016 grain of HCl per cubic foot; with a longer exposure, the limit would probably be extended, as the effect appears to be cumulative. Moisture inhibits the formation of the violet colour, but solutions may be tested for the presence of mineral acid by placing a drop of the solution on a strip of the paper and re-drying the latter at a temperature of 40°. Free mineral acid in vinegar may be detected in this way. W. P. S.

Estimation of Water of Hydration in Cellulose Materials. Carl G. Schwalbe (*Zeitsch. angew. Chem.*, 1908, **21**, 1321—1323).—Distillation with toluene or petroleum and measuring the layer of water in the distillate gives unsatisfactory results. The water of hydration may, however, be determined indirectly by hydrolysing the cellulose material and estimating the dextrose formed, for only hydrated cellulose is inverted comparatively rapidly. Three grams of the material are boiled with 250 c.c. of 5% sulphuric acid for fifteen minutes in a reflux apparatus, the requisite amount of alkali is added, and the solution is titrated with Fehling's solution. L. de K.

Volumetric Process for the Estimation of Chlorates. Edmund Knecht (*J. Soc. Chem. Ind.*, 1908, **27**, 434—437).—In the method described, titanous chloride solution is employed as a reducing agent. The reaction proceeds according to the equation $6TiCl_3 + KClO_3 + 6HCl = 6TiCl_4 + KCl + 3H_2O$, and the estimation is carried out as follows: 50 c.c. of standardised titanous chloride solution are run into 5 c.c. of concentrated hydrochloric acid contained in a conical flask through which a current of carbon dioxide is passed. Ten c.c. of the chlorate solution under examination are then added, and, after the lapse of three minutes, potassium cyanate is added, and the excess of titanous chloride is titrated with standardised iron alum solution. All the values being based on an iron standard, the calculation is simple, for six atoms of iron are equivalent to one molecule of chlorate.

W. P. S.

Detection of Potassium Perchlorate in Potassium Chlorate. Eduard A. Klobbie and H. L. Visser (*Pharm. Weekblad*, 1908, **45**, 718—720).—The presence of potassium perchlorate in potassium chlorate can be detected by slowly evaporating an aqueous solution of the mixture with a trace of potassium permanganate on a microscopic slide, the appearance of the mixed crystals being very characteristic.

A. J. W.

Apparatus for the Estimation of Sulphur in Iron and Steel. Edg. Raymond (*Bull. Soc. chim. Belg.*, 1908, 22, 181—183).—A combination of von Reis's generating flask (round-bottomed flask with side tube, and fitted with separating funnel) and Heinz-Nowicki's absorbing apparatus (cylinder and worm tube).

The absorption tube has now been fitted with a tube carrying a bulb, which also serves the purpose of a funnel through which the solution of bromine in hydrochloric acid is introduced. There is also a small horizontal outlet tube, which is afterwards connected to a long tube destined to carry off the obnoxious bromine fumes.

The gases given off on dissolving the sample in dilute hydrochloric acid are first passed through an empty bulb and then through the absorber. The last traces of hydrogen sulphide are removed by a current of carbon dioxide. The sulphuric acid formed is then estimated as usual. L. de K.

Sodium Peroxide in Certain Quantitative Processes. Samuel W. Parr (*J. Amer. Chem. Soc.*, 1908, 30, 764—770).—*Sulphur (and Arsenic) in Pyritic Ores of Iron and Copper.*—A mixture is made of 10 grams of sodium peroxide, 0·5 gram of potassium chlorate, and 0·5 gram of benzoic acid (by careful shaking). 0·25 Gram of the ore is then carefully mixed with the reagent in an improved Parr bomb, where it is ignited by means of a red-hot nickel wire. The fused mass contains the sulphur as sulphate. *Sulphur in Coal, Coke, Ashes.*—The same process is applied, but in the case of coal and coke, 0·5 gram should be taken for analysis, and the benzoic acid be omitted from the mixture. *Sulphur in Indiarubber.*—0·1 Gram of the sample is burnt with the mixture containing 0·3 gram of benzoic acid. *Halogens, Sulphur, &c., in Organic Compounds.*—Instead of the above mixture the following one is used: 10 grams of sodium peroxide and 1—2 grams of "boro-magnesium" mixture (five parts of boric acid, four parts of potassium nitrate, one part of magnesium, all in fine powder), and 0·3—0·5 gram of the organic compound is taken for analysis. The fused mass contains the halogen and the sulphur. The same mixture also serves for the estimation of carbon in *carborundum.* The fused mass contains the carbon as carbonate. L. de K.

The Estimation of the Total Sulphur in Urine. Artur Konschegg (*Pflüger's Archiv*, 1908, 123, 274—278).—When the organic matter in urine is oxidised with nitric acid alone, and the sulphur is precipitated as sulphate by barium chloride, the results obtained are too low. This is probably due to loss of sulphuric acid by volatilisation. Better results are obtained if potassium nitrate is added to the mixture of urine and fuming nitric acid.

S. B. S.

Use of Phenolphthalein as Indicator in the Titration of Acids in the presence of Sulphurous Acid. M. Emmanuel Pozzi-Escot (*Bull. Assoc. Chim. Sucr. Dist.*, 1908, 25, 941—944).—It is shown that, employing phenolphthalein as indicator, the titre of a sulphuric acid solution remains the same after the addition of normal sodium sulphite as it was before the addition, and consequently this indicator may be used in the presence of sulphurous acid in spite of statements by other observers to the contrary. W. P. S.

Estimation of Nitrogen by Dumas' Method. H. LEEMANN (*Chem. Zeit.*, 1908, **32**, 496).—The carbon dioxide used to expel the air from the combustion tube is generated in a separate tube by heating sodium hydrogen carbonate. Between this and the combustion tube is interposed a tube fitted in the middle with a three-way cock. When the supply of carbon dioxide must be temporarily stopped, the stopcock is turned through 90°, and the carbon dioxide still being evolved escapes through a mercury valve.

When the combustion is over, the sodium hydrogen carbonate is heated again, and the stopcock turned into its original position. L. DE K.

Estimation of Phosphorus in Phosphorised Oils. EMIL WÖRNER (*Pharm. Zeit.*, 1908, **53**, 398).—Five grams of the oil are treated in a 500 c.c. Jena flask, drop by drop, with 5 c.c. of fuming nitric acid, and, when the first violent action is over, a gentle heat is applied. Ten c.c. of a mixture of equal volumes of sulphuric acid and nitric acid are then slowly added, and the heating continued until the charring action of the sulphuric acid becomes visible. Nitric acid is now added until the violent evolution of brown fumes diminishes. If charring occurs again on heating, more nitric acid should be added. Finally, the whole is heated until sulphuric fumes appear, a few more drops of nitric acid being added if necessary.

The residue, when cold, is boiled with 20 c.c. of water, and the phosphoric acid formed estimated by Neumann's process (precipitating with ammonium molybdate and ammonium nitrate, dissolving the yellow precipitate in excess of $N/2$ sodium hydroxide, boiling off the ammonia, and titrating the excess of alkali with $N/2$ acid, with phenolphthalein as indicator; 1 c.c. of alkali = 0·5536 mg. of phosphorus).
L. DE K.

Estimation of Phosphorus in Phosphor-tin. WILLIAM GEMMELL and SYDNEY L. ARCHBUTT (*J. Soc. Chem. Ind.*, 1908, **27**, 427—428).—The following process, in which the phosphorus is evolved as hydride and the latter absorbed and converted into phosphoric acid, is stated to give trustworthy results in the estimation of phosphorus in phosphor-tin. From 2 to 5 grams of the sample are placed in a 500 c.c. flask provided with a two-way tapped funnel and a delivery tube. The gas is absorbed in a set of three Drechsel bottles, the first two containing a depth of about 0·25 inch of bromine, covered by bromine water, and the third, bromine water only. The air is first removed by passing a current of carbon dioxide through the apparatus for five minutes. Concentrated hydrochloric acid is then introduced, the contents of the flask are heated gently until the action has practically ceased, and finally boiled. Carbon dioxide is next passed through the apparatus for a further five minutes to drive any remaining traces of evolved gases into the Drechsel bottles. The contents of the latter are then transferred to a beaker, boiled to remove the bromine, and the phosphoric acid is precipitated as ammonium magnesium phosphate. If arsenic be present in the sample, it is estimated with the phosphorus and separated subsequently.

W. P. S.

Qualitative Analysis of Phosphates and Other Salts Soluble in Acids. H. Caron and D. Raquet (*Bull. Soc. chim.*, 1908, [iv], 3, 622—626).—A critical résumé is given of some of the methods at present in use for the analysis of the group III precipitate when this contains phosphates or other salts soluble in dilute acids, and a new method depending on the use of sodium dioxide is described.

The precipitate is suspended in 10% sodium carbonate solution, a little sodium dioxide added, and the solution boiled for a few seconds. After this treatment, the *solution* will contain any aluminium, chromium, zinc, or uranium that may be present in combination with sodium, as also the acids (oxalic, phosphoric, boric, &c.), whilst in the precipitate will be found manganese (as the hydrated dioxide), iron (as phosphate), and any alkaline-earth compounds, the latter being soluble in acetic acid, by means of which they can be separated from the manganese and iron. Nickel and cobalt should not occur in the group III precipitate in presence of excess of ammonia, but if they do, the cobalt will, after this treatment, occur as the brown oxide and be insoluble in acetic acid, whereas the nickel will be in a form soluble in this acid. A table showing the scheme of separation is given in the original.

T. A. H.

The Reactions of Urine. L. de Jaeger (*Zeitsch. physiol. Chem.*, 1908, 55, 481—504).—To determine the acidity of the urine, the latter was titrated with sodium hydroxide solution (1) in presence of phenolphthalein alone, and (2) in the presence of phenolphthalein after addition of calcium chloride. The phosphoric acid was also estimated. The phosphates are present in the form of diacid salts. If A represents the acidity, x the phosphates present as Na_2HPO_4 or K_2HPO_4, y, phosphates present as calcium phosphate, and z those present as magnesium phosphate, and a represents the acidity due to other substances, then Ac_1 (acidity due to direct titration) $= a + x + 1\frac{1}{3}y + 1\frac{1}{3}z$. The acidity determined after addition of calcium chloride, $Ac_3 = a + 2x + 2y + 2z$. Now $2x + 2y + 2z = \text{mg}P_2O_5/71$ and $Ac = Ac_3 - P_2O_5/71$. By three sets of determinations, therefore, the acidity due to the diacid phosphates and the other acidity can be determined. For the theory of the method by means of which the results are arrived at, reference must be made to the original paper. S. B. S.

Estimation of Carbon in Steel, Ferro-alloys, and Plumbago by means of an Electric Furnace. Charles M. Johnson (*J. Amer. Chem. Soc.*, 1908, 30, 773—779).—The sample contained in a clay boat is heated inside a steel combustion tube in a current of oxygen, the source of heat being a quartz tube wound with Hoskins' resistance wires. Some alloys, such as ferro-chrome, ferro-boron, &c., require an addition of red lead to facilitate the oxidation. For details, the illustration in the original paper should be consulted (also compare Abstr., 1906, ii, 630, as to weighing apparatus and purifying train).

L. DE K.

A New Catalyst in Organic Combustion according to the Carrasco-Plancher Method. ORESTE CARRASCO and E. BELLONI (*J. Pharm. Chim.*, 1908, [vi], **27**, 469—473. Compare Abstr., 1906, ii, 200, 201).—Instead of mixing the substance to be burnt in a current of oxygen with copper oxide or lead chromate, use is made of platinised, powdered, unglazed porcelain (" biscuit platiné "). This is prepared as follows :

Unglazed porcelain is broken up into powder and passed through a sieve having eighty meshes per cm., and then through another having 400 meshes per cm. The mass remaining on the latter is washed, heated with *aqua regia*, again washed, and then calcined. Fifty grams of the " biscuit " are heated on the water-bath with a solution of 1 gram of platinum tetrachloride in 20 c.c. of water, and, when perfectly dry, an excess of solution of ammonium chloride is added. After six hours, the clear liquid is decanted, and the mass dried and ignited in a platinum crucible. The platinising process is then once more repeated. It is advantageous also to platinise the interior tube of the combustion apparatus, which also is constructed of unglazed porcelain.

L. DE K.

Detection of Small Quantities of Carbon Monoxide in Air. JULES OGIER and ÉMILE KOHN-ABREST (*Ann. Chim. anal.*, 1908, **13**, 169—173).—The air is introduced into a graduated tube connected at its lower end with a mercury reservoir. The upper part of the tube is surrounded by a water-jacket, and contains a platinum spiral which can be heated by means of an electric current. After the air has been introduced and its volume measured, the platinum spiral is brought to a red heat, then allowed to cool, again heated, and so on until no further contraction in the volume of the air takes place. The pressure and temperature are adjusted before taking the final reading, and the contraction observed corresponds with half the volume of carbon monoxide present. The ignited air is then treated with potassium hydroxide in order to absorb the carbon dioxide formed ; the contraction observed is equal to the volume of the carbon monoxide. This second manipulation is necessary in case hydrogen is present in the air under examination. Should the air contain hydrocarbon gases, these must be removed previously in the usual way.

Carbon monoxide and dioxide may be estimated in one portion of air by passing a large measured volume of the latter through a series of vessels containing concentrated sulphuric acid, and pumice and sulphuric acid, then through weighed potash bulbs, and finally through a tube containing iodic acid and surrounded by a steam jacket. The carbon dioxide is absorbed in the potash bulbs, whilst the iodine liberated by the action of the carbon monoxide on the iodic acid is collected in potassium iodide solution and titrated. A current of pure air is employed to drive the sample of air through the apparatus.

W. P. S.

Detection of Small Quantities of Carbon Monoxide in Air. JULES OGIER and E. KOHN-ABREST (*Ann. Chim. anal.*, 1908, **13**, 218—224).—The detection is based on the well-known action of carbon monoxide on diluted defibrinated blood and subsequent spectroscopic examination after treating with ammonium sulphide. The volume of air passed before a reaction is obtained gives an idea as to the quantity of carbon monoxide present.

The improvement made by the authors consists in the fact that the air is first deprived of oxygen by means of a solution of sodium hyposulphite. L. DE K.

Universal Volumetric Method for the Estimation of Magnesium. FERNAND REPITON (*Chem. Zentr.*, 1908, i, 1329; from *Mon. Sci.*, 1908, [iv], **22**, i, 33—35).—The solution is evaporated with excess of nitric acid, the residue is taken up with nitric acid, and should phosphoric acid be present, excess of ammonium molybdate is added and the precipitate washed with ammonium nitrate. The filtrate is treated with nitric acid, neutralised with ammonia, and evaporated to dryness. The residue is dissolved in dilute nitric acid and introduced into a measuring flask. A known volume of standardised triammonium phosphate, 2% of citric acid, and ammonia are added, and, after twenty-four hours, the flask is filled up to the mark with ammonia and well shaken. An aliquot part of the filtrate is then titrated with uranium solution for phosphoric acid. The difference in phosphoric acid added and found represents the magnesia.

In the absence of phosphoric acid, the treatment with molybdate is, of course, superfluous. L. DE K.

Separation of Magnesium from the Alkalis by Alcoholic Ammonium Carbonate. FRANK A. GOOCH and ERNEST A. EDDY (*Amer. J. Sci.*, 1908, [iv], **25**, 444—448 *).—A modification of Schaffgotsch's process (*Annalen*, 1857, **104**, 482). The solution containing about 0·25 gram of the mixed salts is diluted to 50 c.c. and 50 c.c. of absolute alcohol are added. The magnesium is now precipitated by adding 50 c.c. of saturated normal ammonium carbonate solution containing 50% of alcohol, and the whole is left for twenty minutes, stirring every five minutes. The precipitate is collected, washed with the ammonium carbonate solution, dried, ignited, and weighed as magnesium oxide.

If the amount of alkali salts is very large, it is advisable to redissolve the precipitate, after decanting the clear liquid, in the smallest possible amount of hydrochloric acid, and to throw down once more with the precipitant. L. DE K.

Volumetric Estimation of Zinc. GEORGE C. STONE (*J. Amer. Chem. Soc.*, 1908, **30**, 904—905).—A criticism of the paper by Keen on this subject (this vol., ii, 431). The method given for standardising is complicated and untrustworthy. The best way to prepare a zinc solution of known strength is to dissolve some zinc in dilute hydrochloric acid, leaving some of it undissolved, and then dilute with

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* and *Zeitsch. anorg. Chem.*, 1908, **58**, 427—432.

water so as to have about 5 grams of the metal per litre. The zinc is then estimated in a definite portion of the liquid as pyrophosphate.
L. DE K.

Accuracy of the Colorimetric Estimation of Lead. H. W. WOUDSTRA (*Zeitsch. anorg. Chem.*, 1908, **58**, 168—175. Compare Kühn Abstr., 1906, ii, 493).—The colorimetric method for the estimation of small quantities of lead by comparison of the colour of the sulphide in colloidal solution with that of a corresponding solution of known strength, used by several previous investigators, has been tested with fairly satisfactory results, but the presence of iron is a source of inaccuracy. It is important that the amount of electrolyte in the tubes should be the same. To avoid the lengthy evaporation after the first precipitation of the sulphide, Kühn's method of getting the sulphide into a form suitable for filtration by shaking with finely-divided asbestos was found satisfactory, but barium chloride is preferable to sodium nitrate for coagulating the precipitate. After filtration, the sulphide is dissolved in hydrochloric acid, evaporated to dryness, the sulphide reprecipitated, and the process repeated. Finally, the chloride is dissolved in water, 10 c.c. of potassium hydroxide and of a saturated solution of hydrogen sulphide added, and the comparison made.

This method gives more accurate results with small quantities (0·05 mg.) of lead than the volumetric method given by Kühn (*loc. cit.*).
G. S.

Estimation of Lead in Lead-Tin Alloys. SIEGMUND HOLZMANN (*Pharm. Zentr.-h.*, 1908, **49**, 417—422).—About 0·5 gram of the alloy is repeatedly oxidised with strong nitric acid in a 200 c.c. platinum crucible with the usual precautions and evaporated to dryness. The residue is treated with 150 c.c. of 10 (vol.) % nitric acid and, without removing the tin oxide, submitted to electrolysis, a platinum dish of about half the size, the outer surface of which has been exposed to a sand blast, serving as electrode. The current should be a weak one, so as to avoid evolution of gas as much as possible. The lead separates as peroxide, and is weighed as such, the last traces of moisture being removed by gently heating the inner side of the dish. L. DE K.

Detection of Copper and Iron. MARCEL DELEPINE (*Bull. Soc. chim.*, 1908, [iv], **3**, 652—654).—The method depends on the production of an intense coloration when a solution of a dialkyldithiocarbamate is added to a solution of a salt of either of these metals in water. The coloured substance produced is extracted with benzene, and the residue left on distilling off the solvent is dissolved in two drops of nitric acid and then ignited. To this residue one drop of nitric acid is added, which dissolves the copper oxide, but leaves the ferric oxide. A few drops of water are added, and the solution decanted into a small vessel, carefully evaporated to dryness, and a drop of a solution of an alkali dialkyldithiocarbamate added, when, if copper is present, an intense yellowish-brown coloration is produced. The residue of ferric oxide is fused with a minute portion of potassium hydrogen sulphate, and to the fused mass, when cold, two drops of a solution of an alkali dialkyldithiocarbamate are added and then ether; on shaking, the ether develops a pink tint if iron is present. In dealing with solid matter, the latter is incinerated, the ash, dissolved in nitric acid, is re-ignited, and the residue so obtained is treated as described above. The most convenient reagent to employ is a solution of a dialkylamine dialkyldithiocarbamate, which can be made by simply mixing the appropriate dialkylamine with carbon disulphide, and diluting to at least one per cent. strength with alcohol or water. Such a reagent will detect 1 part of copper in 1,000,000 of solution. Colorations are also produced with nickel and cobalt. T. A. H.

Volumetric Estimation of Copper. GEORGE S. JAMIESON, L. H. LEVY, and HENRY L. WELLS (*J. Amer. Chem. Soc.*, 1908, **30**, 760—764).—The sulphate solution obtained from the ore in the usual manner is nearly neutralised with ammonia, sulphurous acid is added, and, after heating to boiling, the copper is precipitated with ammonium thiocyanate. The filter containing the washed precipitate is placed in a bottle containing 5 c.c. of chloroform, 20 c.c. of water, and 30 c.c. of hydrochloric acid. The liquid is now titrated, with constant shaking, with standard solution of potassium iodate (11·784 grams per litre; 1 c.c. = 0·002 gram of copper) until the violet colour of the chloroform noticed at first suddenly disappears. L. DE K.

Rapid Method for the Estimation of Mercuric Salts in Aqueous Solution. SAMUEL G. LIVERSEDGE (*Analyst*, 1908, **33**, 217—218).—The method depends on the solubility of mercuric iodide in ether, and is particularly applicable to the estimation of small quantities of mercury, as, for instance, in the "liquor hydrargyri perchloridi" of the Pharmacopœia. Twenty-five c.c. of the mercury solution are placed in a separating funnel, and 5% potassium iodide solution is added, drop by drop, until no further precipitate is produced; a large excess must be avoided. A few drops of phosphoric acid solution are next added in order to reduce the solvent action of the excess of potassium iodide on the mercuric iodide, and the mixture is then extracted three times with ether, using about 50 c.c. each time. The ethereal extracts are washed with water, evaporated in a weighed flask, and the residue of mercuric iodide, after being dried at 100°, is weighed. W. P. S.

Acidimetric Estimation of both Mercury Components in Mercury Oxycyanide. ERWIN RUPP (*Pharm. Zeit.*, 1908, **58**, 435—436).—0·3 Gram of the sample is dissolved in 50 c.c. of hot water containing 0·5 gram of sodium chloride, and, when cold, titrated with *N*/10 hydrochloric acid, using 1 to 2 drops of 0·2% methyl-orange as indicator. This gives the mercuric oxide only; 1 c.c. of acid = 0·0108 gram of HgO.

1·5 to 2 Grams of potassium iodide and 100 to 125 c.c. of water are now added, by which neutrality is restored, and the titration is repeated. The result represents the mercuric cyanide; 1 c.c. of acid = 0·0126 gram of HgC_2N_2. L. DE K.

Detection of Manganese and Chromium in the presence of each other. WILLIAM J. KARSLAKE (*J. Amer. Chem. Soc.*, 1908, **30**, 905).—To the cold dilute nitric or sulphuric acid solution of the mixture are added 1 to 2 c.c. of silver nitrate reagent and then 2 to 5 grams of potassium persulphate, and the whole is heated until practically no more oxygen is evolved. The manganese and chromium are thus converted into their respective acids, the permanganate colour showing itself first. In order to detect the chromium, the colour of which is obscured by the permanganate, the liquid is cooled and shaken with ether or acetic ether and excess of hydrogen peroxide; the permanganate is decomposed, and the perchromic acid formed dissolves in the ether with a blue colour. L. DE K.

Oxidising Power of Sodium Peroxide; its use in Qualitative Analysis. DANIEL F. CALHANE (*J. Amer. Chem. Soc.*, 1908, **30**, 770—773).—Sodium peroxide in alkaline medium is recommended for the detection of chromium in presence of iron and aluminium. The oxidation, however, goes as far as the perchromate stage, and therefore the usual confirmatory test with lead acetate is not obtained until the liquid has been heated so as to reduce the perchromic acid.

L. DE K.

Simultaneous Qualitative Test for Nickel and Cobalt. HERMANN GROSSMANN and WALTER HEILBORN (*Ber.*, 1908, **41**, 1878—1880. Compare Grossmann and Schück, Abstr., 1906, ii, 903; 1907, ii, 582).—The presence of both nickel and cobalt may be detected with certainty by the following test: the solution to be examined is concentrated, freed from a large excess of acid, treated with an excess of ammonia, and then with 10—20 c.c. of a 10% sucrose solution; a sufficient quantity of a solution of dicyanodiamidine sulphate is added, and finally sodium hydroxide. The nickel present separates as a yellow, crystalline precipitate of nickel dicyanodiamidine, leaving, in the presence of cobalt, an intense red or reddish-violet solution.

W. H. G.

Estimation of Nickel. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 186*).—A reply to the criticism of Grossman and Schück (this vol., ii, 230). The author points out that he has laid stress on the fact that the separation from cobalt is accompanied by the formation of the double molybdate, and that he has already indicated the means to be taken to prevent the precipitation of blue cobalt molybdate. He has never claimed that the molybdate process is capable of estimating mere traces of nickel in the presence of cobalt.

W. P. S.

Rapid Estimation of Nickel in the presence of all Elements of Groups 4, 5, and 6. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 215—216).—The solution is concentrated to a small bulk, and, after neutralising the excess of acid, a large excess of a solution of ammonium molybdate is added, also a little ammonium chloride. The whole is heated to 60—70° and well shaken for a few minutes, when it is suddenly cooled. The precipitate, which contains all the nickel, is washed with saturated ammonium chloride solution, and then boiled with water and excess of ammonia for a few minutes. All the nickel is dissolved, and thus separated from any iron, chromium, manganese, and aluminium. If it is feared that the precipitate still retains nickel, it may be redissolved in hydrochloric acid and again treated with ammonia in excess.

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* and *Bull. Soc. chim.*, 1908, [iv], **3**, 775.

The united ammoniacal filtrates are boiled with potassium hydroxide to expel the ammonia, and a little bromine is added to peroxidise the nickel, which is then washed, redissolved in hydrochloric acid, and finally deposited by electrolysis. L. DE K.

Stannometric Estimation of Alkali Vanadates. T. WARYNSKI and B. MDIVANI (*Bull. Soc. chim.*, 1908, [iv], **3**, 626—628; *Ann. Chim. anal.*, 1908, **13**, 209).—The method depends on the reduction of vanadic acid by stannous chloride in presence of acids. The best results are obtained with a solution containing approximately 2% of stannous chloride and standardised against a solution of iodine of known strength. As indicator, ammonium molybdate, which gives a blue coloration with mere traces of stannous chloride, is used, drops of the indicator being placed on white porcelain. The results are equally good in presence of hydrochloric or sulphuric acid and in either hot or cold solution. T. A. H.

Electrolytic Estimation of Antimony. O. SCHEEN (*Zeitsch. Elektrochem.*, 1908, **14**, 257—263).—The electrolytic deposition of antimony from a solution containing sodium sulphide and potassium cyanide has been said to yield too high results. Sodium sulphide (80 c.c.; D 1·14) and potassium cyanide (30 c.c.; 30%) are mixed with the neutralised antimony solution, the mixture diluted to 140—150 c.c., and electrolysed in a platinum basin with 1·2 to 1·3 amperes at 60—70°. The voltage must not exceed 1·7 volts. The results obtained are too high with a thickly platinised basin, with wire gauze cathodes, and with rotating electrodes; on the other hand, perfectly correct results are obtained with a polished basin (using not more than 0·1 gram of antimony) and with a very slightly etched or platinised basin, using up to 0·2 gram of antimony. A large excess of sodium hydroxide or too high current density also leads to incorrect results. On a rough surface, the deposit is formed most quickly on the highest points, and so the depressions are bridged over and enclosures of solution are formed which cannot be removed by washing. T. E.

Electrolytic Estimation of Antimony. ERNST COHEN (*Zeitsch. Elektrochem.*, 1908, **14**, 301).—The error in the electrolytic estimation of antimony has been shown by Dormaar (Abstr., 1907, ii, 200) and by Foerster and Wolf (*ibid.*, ii, 508) to be due to oxidation of the antimony, and only to a very small extent to enclosures of mother liquor, as Scheen supposes (preceding abstract). T. E.

Volumetric Estimation of Antimony. A. KOLB and R. FORMHALS (*Zeitsch. anorg. Chem.*, 1908, **58**, 202—208).—In the light of the results described by the authors (this vol., ii, 599), it is pointed out that antimony, in the form of antimonic acid, can be titrated accurately by the iodine-thiosulphate method when the hydrochloric acid and potassium iodide are used in sufficient concentration; 20—25 c.c. of acid, D 1·125, and 0·5—1·0 grams of the iodide give good results when the total volume is 100 c.c. It is further of advantage to use air-free reagents.

When metallic antimony is dissolved in aqua regia and the excess of nitric acid removed by evaporation, this volumetric method gives results which are about 1% too low, owing probably to incomplete oxidation of the antimony. Accurate results are obtained by the following somewhat complicated method. The metal or a compound is dissolved in aqua regia or in bromine and hydrochloric acid, the nitric acid or bromine removed by evaporation, the solution diluted, the antimony precipitated as sulphide, the latter dissolved in dilute potassium hydroxide, and the mixture oxidised by hydrogen peroxide, first in dilute and then in strong alkali; the solution is then made strongly acid with hydrochloric acid, potassium iodide added, and the titration completed in the usual way. G. S.

The "Hydrogen Number" as a means for determining Unsaturated Organic Compounds in a manner similar to the Iodine Numbers of Hübl and Wys. Sergius Fokin (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 700—709).—The author defines the "hydrogen number" of an organic compound as the number of c.c. of hydrogen at 0° and 760 mm. pressure absorbed by one gram of the compound. For carrying out the test, the author has devised an apparatus consisting of a distillation flask (50—150 c.c.) having a small beaker fused inside on the bottom and connected by means of the side-tube to a gas burette and a gasometer containing hydrogen. In the small beaker are placed 0·1—0·02 gram of molecular platinum moistened with 0·25—0·5 c.c. of water, and in the flask, the substance to be examined and 20—30 c.c. of alcohol free from dissolved oxygen. The flask is shaken by a shaking machine.

The following are the hydrogen numbers obtained by the author, the values in brackets being either the hydrogen numbers corresponding with Wys' iodine number, or, where indicated, the theoretical hydrogen numbers. Elaidic acid, 78·6—81·4 (78·8); oleic acid, 86·6—87·2 (86·2); fatty acids from sunflower oil, 119·6—120·8 (122·9); fatty acids from linseed oil, 164·9—166·3 (166·0); castor oil, 73·7 (75·5); croton oil, 260·9 (theoretical 258·4); undecoic acid, 115·6 (114·1); erucic acid, 39·4 (65·6); maleic acid, 190·6—191·6 (theoretical 191); aconitic acid, 131·0 (theoretical 127·7); citraconic acid, 175·2 (theoretical 171·1); cinnamic acid, 215·0 (150·1). Colophony, naphthalene, benzoic acid, resorcinol, quinol, catechol, pyrogallol, and cymene give zero hydrogen numbers. T. H. P.

Indirect Estimation of Alcohol by Refraction. Adolph Frank (*Chem. Zeit.*, 1908, **32**, 569—570).—The indirect estimation of alcohol in worts, beers, wines, cordials, &c., by observing the refraction before and after expelling the alcohol has been shown by the author to be quite untrustworthy. L. de K.

Detection of Methoxyl- and Methylimino-groups. Josef Herzig (*Monatsh.*, 1908, **29**, 295—297. Compare Kirpal, this vol., ii, 436).—Goldschmiedt (Abstr., 1905, i, 900) and Herzig and Polak (this vol., i, 546) have shown that tetramethylellagic acid and similar compounds must be heated several hours with hydriodic acid before all the methoxyl groups are completely hydrolysed. In estimating methoxyl groups by Zeisel's method, it is therefore advisable to heat several times with fresh additions of strong hydriodic acid, and to use fresh solutions of silver nitrate, until the latter ceases to become turbid on dilution. Further, the presence of a methoxyl- and not a methylimino-group is only indicated with certainty when the theoretical quantity of methyl iodide is liberated in the time normally required for the estimation of methoxyl by Zeisel's method (compare Herzig and Meyer, Abstr., 1895, ii, 296; 1898, i, 53). W. H. G.

Bang's Method of Estimating Sugar. H. Jessen-Hansen (*Biochem. Zeitsch*, 1908, **10**, 249—257. Compare Abstr., 1906, ii, 136).—This method was tested, and is highly commended.

W. D. H.

The Reduction of Cuprous Oxide in the Estimation of Reducing Sugars. Vladimír Staněk (*Zeitsch. Zuckerind. Böhm.*, 1908, **32**, 497—499).—The cuprous oxide obtained by the action of a reducing sugar on Fehling's solution is collected on a layer of asbestos in a Gooch porcelain or copper crucible and washed in the usual way. The crucible is then gently heated over a spirit-flame, and immediately suspended in a beaker containing a small quantity of 70% methyl alcohol, the beaker being heated with a small flame, so that it is filled with vapours of methyl alcohol. The latter reduce the cuprous oxide to metallic copper, and the crucible and its contents are then dried at a temperature of 100° and weighed. Before use, the crucible containing a layer of asbestos is submitted to similar treatment.

W. P. S.

Colour and Spectral Reactions of Sugars with Naphtharesorcinol and Hydrochloric Acid. Bernhard Tollens and F. Rorive (*Zeitsch. Ver. deut. Zuckerind.*, 1908, **629**, 521—526; *Ber.*, 1908, **41**, 1783—1787).—The authors have examined the colour reactions of a number of sugars and allied substances with naphtharesorcinol and hydrochloric acid. A few grains of the sugar and about the same quantity of naphtharesorcinol are mixed in a test-tube with 10 c.c. of a mixture of equal volumes of hydrochloric acid, D 1·19, and water, and the liquid heated slowly to gentle boiling, which is maintained for one to three minutes. After three to five minutes, the tube is cooled, the solution filtered, and the residue on the filter washed three or four times with water until the wash-water becomes colourless. Alcohol, 95° Tr, is then poured on to the filter, and the alcoholic solution of the residue passing through is examined spectroscopically.

When gently warmed with naphtharesorcinol and hydrochloric acid, lævulose and sorbose give a fine red coloration, which is somewhat more violet than that given by lævulose with resorcinol. Dextrose and mannose, as well as substances which yield these sugars when hydrolysed, give, when treated as above, faintly fluorescent alcoholic solutions, which exhibit a band in the green portion of the spectrum. In absence of lævulose, galactose and galactosides yield alcoholic solutions showing a band on the *D*-line and one in the green; if lævulose is present, it may be destroyed beforehand by heating with the diluted hydrochloric acid. With pentoses, and more especially with methylpentoses, the green fluorescence of the alcoholic solutions obtained is very marked; the methylpentoses yield violet-blue alcoholic solutions, which exhibit a band on the *D*-line and another in the green. Glycuronic acid gives a fine blue alcoholic solution showing a band on the *D*-line. T. H. P.

Simple Method of Detecting Glycuronic Acid and its Derivatives in Presence of Pentoses and in Urine. BERNHARD TOLLENS (*Zeitsch. Ver. deut. Zuckerind.*, 1908, **629**, 526—528; *Ber.*, 1908, **41**, 1788—1790. Compare preceding Abstract).—Glycuronic acid may be readily detected as follows. A piece of the substance to be examined as large as a pea is heated in a wide test-tube with 5—6 c.c. of water, 0·5—1 c.c. of a 1% alcoholic naphtharesorcinol solution, and 6—7 c.c. of hydrochloric acid, D 1·19, the liquid being kept gently boiling for a minute. After standing for four minutes, the liquid is cooled, mixed with an equal volume of ether, and well shaken. When the liquid has settled, the upper ethereal solution has a blue or red colour, exhibits blue fluorescence, and has a band slightly to the right of the D-line if glycuronic acid is present; 0·1%, or even less, of glycuronic acid can be detected by this reaction, which is also given by compound glycuronic acids and by various plants, for instance, *Fucus* and *Laminaria*. T. H. P.

The Quantity of Formic Acid in Honey. K. FARNSTEINER (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 598—604).—It is shown that only very small quantities of free formic acid (from 0·0011 to 0·0024%) occur in honey, the greater part of the acidity of the latter being due to some other acid, possibly malic acid. About 0·02% of formic acid is present in a combined state, probably as an ester. W. P. S.

Detection of Formic Acid in Foods. ALPHEUS G. WOODMAN and A. L. BURWELL (*Tech. Quarterly*, 1908, **21**, 1—3).—In the method proposed, the formic acid is converted into its calcium salt, and the latter is subjected to dry distillation in the presence of calcium acetate. The reaction proceeds according to the equation:

$$(HCO_2)_2Ca + (CH_3{\cdot}CO_2)_2Ca = 2CaCO_3 + 2H_3{\cdot}CHO.$$

The acetaldehyde formed is then detected by means of magenta-sulphurous acid reagent. The details of the method are: 50 grams of the sample are acidified with 20 c.c. of 20% phosphoric acid and steam distilled until about 200 c.c. of distillate have been collected. To the distillate are added 2 c.c. of 30% acetic acid and 20 c.c., or more, of milk of lime, and the solution is evaporated to dryness. The dry residue is then transferred to a test-tube provided with a bent delivery tube, and is there subjected to dry distillation. The distillate is collected in a little water, and the solution is treated with the magenta-sulphurous acid reagent. A slight coloration nearly always develops, even in the absence of formic acid, and the latter must not be considered to have been present in the sample unless the coloration obtained exceeds that of a solution prepared by diluting 8 c.c. of cupric chloride solution (12 grams of the crystallised salt per litre) and 12·5 c.c. of cobaltous chloride solution (24 grams of the crystallised salt and 100 c.c. of hydrochloric acid per litre) with water to 100 c.c. If the food contained 0·05 per cent. of formic acid, the coloration obtained will be about six times as dark as that of the comparison solution. W. P. S.

Detection of Citric Acid in Wine, &c. G. FAVREL (*Ann. Chim. anal.*, 1908, **13**, 177—179).—When citric acid is heated with sulphuric acid, formic and acetonedicarboxylic acids are formed; the latter acid may then be separated and identified. In testing wine, 100 c.c. are evaporated to dryness on the water-bath, the residue is dissolved in 7 c.c. of boiling water, and to the solution are added 35 c.c. of 95% alcohol. At the end of thirty minutes, the mixture is passed through a filter, and the filtrate is treated with 0·4 gram of calcium acetate dissolved in 5 c.c. of water. The calcium citrate which is precipitated (if citric acid is present in the wine) is collected on a filter and, when dry, transferred to a test-tube, 3 c.c. of concentrated sulphuric acid, heated previously to 100°, are added, and the solution is kept at a temperature of 80° to 90° for two minutes. It is then cooled, diluted with three times its volume of water, again cooled, and shaken with alcohol-free ether. On evaporating the ethereal solution, acetonedicarboxylic acid crystallises out; when dissolved in water, this acid gives a characteristic violet-red coloration with ferric chloride. The test is not affected by the presence of formic, acetic, butyric, tartaric, malic, lactic, or oxalic acids in the wine or other liquid under examination, but salicylic acid must be removed previously by extraction with ether after acidifying with hydrochloric acid. The method will detect 0·005% of citric acid in wine. W. P. S.

Citric Acid and Natural Wines. H. ASTRUC (*Ann. Chim. anal.*, 1908, **13**, 224—226).—The author states that natural wines may contain citric acid. The presence of this acid is detected with safety by Denigès' reagent (ministerial decision, Jan. 18, 1907).
L. DE K.

The Normal Citric Acid of Wines. GEORGES DENIGÈS (*Ann. Chim. anal.*, 1908, **13**, 226—227).—The author states that he had noticed ten years ago that new wines contain 3—6 centigrams of citric acid per litre as a natural constituent.

Probably owing to bacterial influences, the acid cannot be detected in some old samples. L. DE K.

Phenolsulphonic Acid and its Salts. GERHARD HÜBENER (*Chem. Zeit.*, 1908, **32**, 485—486).—The phenol group is but imperfectly precipitated by bromine, and cannot therefore be titrated by the usual volumetric bromine and iodine methods. On boiling, however, with a saturated solution of bromine in hydrochloric acid, the phenol is completely eliminated, whilst the sulphonyl group is converted into sulphuric acid, which may then be estimated in the filtrate as usual. From this should be deducted any free sulphuric acid the compound may contain, which is estimated by simply adding barium chloride and a few drops of hydrochloric acid. L. DE K.

The Freezing Point of Milk. A Method of Detecting Adulteration. W. R. GELSTON ATKINS (*Chem. News*, 1908, **97**, 241—242).—The results of a considerable number of determinations are given, showing that the freezing point of milk is practically a constant, namely, $-0{\cdot}55°$; the variations from this rarely exceed 0·03° above or below the mean. Determinations of the freezing point and specific gravity of a sample of milk are sufficient to show whether water has been added or fat removed. The freezing point of milk is not affected by the presence or absence of fats. W. P. S.

Flask for Fat Estimation. WILBUR L. DUBOIS (*J. Amer. Chem. Soc.*, 1908, **30**, 797—798).—The flask recommended by Wheeler and Hartwell (Abstr., 1901, ii, 586) and modified by Robison has been replaced by one of the Erlenmeyer type. The flask is fitted to the condensing apparatus by means of a seal consisting of a maple cup made to fit over an ordinary rubber stopper through which passes the neck of the flask. The seal is made by mercury in a manner similar to the device used by Wheeler and Hartwell. L. DE K.

New Method for the Estimation of Fat in Cocoa. ADOLF KREUTZ (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 680—683).—A weighed portion of about 1·5 grams of the cocoa is placed in a small flask, 3 grams of solid chloral alcoholate are added, and the mixture is heated on a water-bath until melted to a homogeneous mass. About 15 c.c. of ether are next added, and the contents of the flask are shaken; a further quantity of 35 c.c. of ether are then added, and the mixture is poured on a filter, the ethereal filtrate being received in a weighed flask. The residue on the filter is washed twice with ether, the washings being also collected in the flask, from which the ether is then evaporated, and the residue of fat dried at a temperature of 105—110° and weighed. The chloral alcoholate is expelled completely from the fat at this temperature. W. P. S.

The Ethyl Ester Value of Fats. A New Constant for the Detection of Cocoanut Oil. JOSEF HANUŠ and LAD. ŠTEKL (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 577—587).—The process is based mainly on the different amounts of lauric acid occurring in cocoanut oil and other fats. The glycerides are converted into ethyl esters and the volatile portion of these is distilled and estimated. Five grams of the filtered fat to be tested for cocoanut oil are placed in a 200 c.c. Erlenmeyer flask and heated for fifteen minutes to a temperature

of 50°. Thirty c.c. of $N/10$ alcoholic potassium hydroxide solution are then added, the contents of the flask are shaken until a clear solution is obtained, and again heated for ten minutes at 50°. Two c.c. of sulphuric acid (which quantity must be capable of exactly neutralising the 30 c.c. of alkali added) are then added, the whole is diluted with water to a volume of 145 c.c., and distilled, a little pumice-stone being added. The first 30 c.c. of alcoholic distillate are rejected, whilst the next 100 c.c. are collected and transferred to a flask. Alcohol is added until the turbid solution becomes clear, and the free acid is titrated, using phenolphthalein as indicator; 40 c.c. of $N/2$ alcoholic potassium hydroxide solution are added, the solution is boiled for forty-five minutes under a reflux apparatus, and the excess of alkali is then titrated. The quantity of alkali required for the saponification, expressed in c.c. of $N/10$ solution, is termed the ethyl ester value of the fat. This value for various fats is: cocoanut oil, over 40; palmnut oil, about 25; butter, from 7 to 14; lard, cacao butter, sesame oil, cotton oil, olive oil, &c., less than 3. The value is particularly useful for detecting the presence of cocoanut oil in lard, cacao butter, and margarine, but it will not indicate, with certainty, a less quantity than 15% of this oil in butter.
W. P. S.

Abrastol. Dioscoride Vitali (*Boll. chim. farm.*, 1908, **47**, 291—301).—Abrastol, or calcium β-naphthol-α-sulphonate, is used as an internal antiseptic and as a precipitant for tartrates in wine, instead of other calcium salts. A number of colour reactions are described, one of the best being that obtained by evaporating with a solution of mercurous nitrate (reddish-violet colour). From wine, the acid may be extracted by amyl alcohol or ethyl acetate, or it may be isolated as potassium salt on evaporating the wine, after making it alkaline, and extracting the residue with alcohol; the acid can then be further purified by lead acetate and hydrogen sulphide. G. B.

Gall-Iron Inks. Erich Kedesdy (*Chem. Zentr.*, 1908, i, 991; from *Mitt. K. Materialprüfs.-Amt.*, **25**, 268—269).—*Detection of Tannin and Gallic Acid with Molybdate Solution.*—Tannin and gallic acid give with acid ammonium molybdate solution a sherry or even dark brown coloration. The residue obtained from the extraction with ethyl acetate (see this vol., ii, 544) is dissolved in 100 c.c. of water, 1—2 c.c. are diluted to 25 c.c., and mixed with 5 c.c. of Finkener's molybdate solution.

An approximate estimation may be made by comparing the depth of colour with a standard solution. This may be made by extracting an ink of known composition with ethyl acetate and proceeding as already directed. L. de K.

A Colour Reaction of Histidine. Franz Knoop (*Beitr. chem. Physiol. Path.*, 1908, ii, 356).—On adding bromine water to an aqueous solution of histidine or a histidine salt, decolorisation at first takes place. On further addition of the reagent, the mixture assumes a permanent yellow colour; on warming, it again becomes at first

colourless, but after a time a pink colour appears, which afterwards deepens to a deep wine-red. Later, black, amorphous particles separate from the solution. Too large an excess of bromine destroys the reaction. A number of iminoazole derivatives nearly allied to histidine fail to give the reaction. The reaction is sensitive with solution of 1 in 1000.
S. B. S.

Alkaloid Reactions (Tropacocaine). C. Reichard (*Pharm. Zentr.-h.*, 1908, **49**, 337—342).—A series of tests is given of which the following are examples. When examined with a magnifying glass, tropacocaine hydrochloride shows a strong double refraction, and exhibits all the colours of the rainbow. When moistened with water, it gives no aromatic odour, thus distinguishing it from cocaine. Warmed with potassium ethyl sulphate and sulphuric acid, it gives the odour of ethyl benzoate, whilst cocaine gives a strong odour of peppermint.

Sulphuric acid gives no characteristic colour. The reactions with sodium nitroprusside and with copper sulphate are very much like those obtained with cocaine. A more characteristic reaction is obtained with nitric acid. On evaporating with nitric acid to dryness, an opaque, white residue is obtained; cocaine yields a transparent, varnish-like substance. The behaviour with cobalt nitrate is also important. If to a small drop of cobalt nitrate is added a slight excess of tropacocaine hydrochloride, the mixture turns yellow; on warming, the colour changes to blue, but on cooling the yellow colour is restored. Cocaine when treated similarly yields a permanent blue spot.
L. de K.

Estimation of Albumin in Urine by Esbach's Method. J. C. van der Harst (*Pharm. Weekblad*, 1908, **45**, 489—492).—A criticism of the popular Esbach albumimeter, the indiscriminate use of which has already been condemned by various authorities. It now appears that some urines contain a colloidal substance which prevents the formation of the albumin picrate; this may, however, be eliminated by boiling the urine with strong acetic acid, but in such a case a different apparatus would have to be constructed.
L. de K.

Reaction between Hæmoglobin and the Leuco-base of Malachite-green. George A. Buckmaster (*Proc. physiol. Soc.*, 1908, xi—xiv.; *J. Physiol.*, **37**).—This base (tetramethyldiaminotriphenylmethane), first used by Adler for the detection of blood, is recommended for that purpose. Like the guaiacum reaction, the bluish-green colour developed is not due to the chlorides of blood (as Senter suggested) or to any ferment, but to the iron in hæmoglobin and its derivatives. It is termed a pseudo-peroxydase reaction.
W. D. H.

Sensitive Reaction for Carboxy-hæmoglobin. Angelo de Dominicis (*Boll. chim. farm.*, 1908, **47**, 258—260).—The author finds that the tannic acid test for carboxy-hæmoglobin can be controlled by examining the mixture of blood and tannic acid solution spectroscopically by means of reflected light. He uses Schulz's modification of this test, according to which 2 c.c. of blood, diluted to 10 c.c. with water, are shaken with 10 c.c. of 3% aqueous tannic acid solution; with normal blood, a brick-red colour is formed, which changes to brownish-grey, whilst blood containing carbon monoxide yields a persistent rose-red coloration. The spectroscopic examination is made twenty-four hours after the tannic acid has been added to the blood. The normal blood then exhibits a band in the red, whilst the bands due to the hæmoglobin are scarcely visible; when carbon monoxide is present, either no band or only a light one appears in the red, whilst the hæmoglobin bands are much more intense.

T. H. P.

Composition of Meat Extract. Karl Micko (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 449—462).—The main part of the paper is devoted to the behaviour on hydrolysis of those constituents of meat extract which remain in solution after saturating the liquid with zinc sulphate. They are recovered from the filtrate by evaporating in a vacuum and extracting the dry residue with ammonia and alcohol (1 : 3).

When, after the purification with lead hydroxide, &c., the syrupy mass is boiled with hydrochloric acid, most of the matter is precipitated by phosphotungstic acid (diamino-acids). From the filtrate may then be recovered: taurine, glyoxime, alanine, leucine, aspartic acid, and glutamic acid; for working details, the original article should be consulted.

L. de K.

The Mechanism of the Guaiacum Reaction. C. E. Carlson (*Zeitsch. physiol. Chem.*, 1908, **55**, 260—294).—The theory is advanced that the blue coloration of guaiacum tincture takes place in those reactions in which the atoms of water are in a "labile" condition and readily combine, as in the reaction $NaOH + HCl = NaCl + H_2O$. It is to the formation of water in such reactions that the blue coloration is due. There are certain exceptions, such as the reaction of sulphuric acid on zinc hydroxide, but a theory is advanced to explain why water is not formed in such reactions, but a stable hydrate. A theory is also advanced to explain the hydrolysis by means of enzymes, and to show why the latter give the guaiacum reaction.

S. B. S.

Criticism of Joulie's Process for Estimating the Acidity of Urine. Fernand Repiton (*Ann. Chim. anal.*, 1908, **13**, 147—148. Compare Abstr., 1907, ii, 409).—A controversy with Joulie on the subject of acidity in urines (compare Joulie, *Clinique et laboratoire*, Aug., 1907).

L. de K.

General and Physical Chemistry.

The Ultimate Rays of the Metalloids, Tellurium, Phosphorus, Arsenic, Antimony, Carbon, Silicon, and Boron. Antoine de Gramont (*Compt. rend.*, 1908, **146**, 1260—1263. Compare Abstr., 1907, ii, 517).—Alloys of lead or tin with 10% to 0·001% of the metalloids mentioned in the title have been examined spectroscopically, and the ultimate rays of great persistence found to coincide with those previously observed in minerals containing the same metalloids. The lines are common to the arc and spark spectra, with or without condensation, and are not masked by the presence of other substances. They are all situated in the ultra-violet, and can only be photographed when prisms of quartz or calcspar are employed. W. O. W.

The Red Portion of the Calcium Chloride Arc Spectrum. C. F. O. Meisenbach (*Zeitsch. wiss. Photographie, Photophysik. Photochem.*, 1908, **6**, 258—270).—The red end of the calcium arc spectrum has been studied photographically by means of red-sensitive plates, a large Rowland grating being used. The number of bands observed is very large, and only a few of them can be resolved. Since the bands are sometimes degraded towards the red and sometimes towards the violet, it appears that bands of different origin, due probably to the chloride, the oxide, and the metal, occur together. Detailed measurements of the bands and of the line spectrum are given. Four groups of bands are found to obey Deslandres' law. C. H. D.

The Separation and Quantitative Spectra of Cerium, Lanthanum, and Didymium. James H. Pollok and A. G. G. Leonard (*Sci. Proc. Roy. Dubl. Soc.*, 1908, **11**, 257—269).—The separation of cerium from mixed cerite earths by the action of chlorine in alkaline solution is recommended, fusion of the nitrates being employed to separate lanthanum, didymium, and yttrium. Neodymium and praseodymium were not separated. The residual lines on sparking dilute solutions between gold electrodes have been recorded and photographed in the manner already described (Abstr., 1907, ii, 918). C. H. D.

The Quantitative Spectra of Molybdenum, Tungsten, Thorium, and Zirconium. A. G. G. Leonard (*Sci. Proc. Roy. Dubl. Soc.*, 1908, **11**, 270—279. Compare preceding abstract).—The lines observed on sparking solutions containing 1, 0·1, 0·01, and 0·001% of the element between gold electrodes have been measured and photographed. The most persistent lines occur in the more refrangible part of the spectrum. The vibrations of small wave-length are therefore the most easily excited. This explains the greater tendency of ultra-violet rays to induce chemical action. C. H. D.

A New Arrangement of the König Spectrophotometer and its Application to the Determination of Chemical Equilibria. JOEL HILDEBRAND (*Zeitsch. Elektrochem.*, 1908, **14**, 349—353).—Two small tungsten filament lamps are connected in series so that variations of current affect them equally. The light from one lamp passes through the solution. The two beams are then polarised at right angles to each other, pass a direct vision prism, and are received by a telescope with a Nicol prism in the eye-piece. The telescope can be adjusted to receive light of any desired wave-length; by rotating the Nicol, the two beams can be made of the same intensity.

The dissociation of phenolphthalein is measured by means of the instrument. Phenolphthalein is dissolved in solutions of ammonia and ammonium chloride in which the concentration of the hydrogen ions is known. The amount of phenolphthalein dissociated is obtained by comparing the absorption with that observed in a completely dissociated solution. The dissociation constant, $[H^{\cdot}][R']/[HR]$, where $[R']$ is the concentration of the phenolphthalein ion, is found to be $1{\cdot}7 \times 10^{-10}$ for solutions in which from 5 to 65% of the phenolphthalein is dissociated; for smaller degrees of dissociation smaller values are observed. T. E.

Optical Investigation of the Condition of Chromate and Permanganate Solutions. ARTHUR HANTZSCH and ROBERT H. CLARK (*Zeitsch. physikal. Chem.*, 1908, **63**, 367—381).—By a study of absorption spectra and determination of molecular extinction coefficients, the authors have reached results for chromates, dichromates, and permanganates similar to those already reached for platinichlorides (see this vol., ii, 447).

Solutions of chromium trioxide in pure water and in aqueous sulphuric acid are at all concentrations optically identical with each other and with feebly acid solutions of potassium dichromate. Solutions of the latter in pure water deviate very slightly in the direction of monochromate solutions. Solutions of monochromates in pure water, in alkalis, and in methyl alcohol are at all concentrations quite different from dichromate and chromic acid solutions in their optical characteristics, but are identical among themselves except for a slight deviation of the pure aqueous solutions in the direction of the dichromate solution. The optical characteristics are independent, not only of the concentration and the solvent, but also of the temperature.

The chromophoric group in all acid solutions is the completely saturated complex Cr_2O_7; in all alkaline solutions the corresponding complex CrO_4. From the optical point of view, it is immaterial whether these complexes are combined with hydrogen or alkali metal, dissociated or undissociated; the colour of the ions must be the same as that of the undissociated molecule.

Similarly, the absorption of permanganic acid and its salts is not appreciably influenced by the solvent, the temperature, or the degree of dissociation.

Emphasis is laid on the value of this optical method in studying constitutive changes due to the chemical influence of the solvent. J. C. P.

Attempt to Produce Dichroism by Pressure in Silver Haloids. FELIX CORNU (*Centr. Min.*, 1908, 393—395).—A. von Lasaulx, in 1879, made the observation that dichroism is developed by pressure in crystals of chlorargyrite from Schneeberg, but the present author has been unable to confirm this observation by his experiments on chlorargyrite, embolite, and bromyrite from various other localities.

L. J. S.

Apparatus for Producing Flame Colorations and Other Changes of a Non-luminous Flame. F. SCRIBA (*Chem. Zentr.*, 1908, i, 1753; from *Zeitsch. physik-chem. Unterr.*, 1908, **21**, 110—111).—A modified form of Bunsen burner made of glass and having a glass tube bent downward as air inlet. By this means a flame coloration is obtained by introducing the air inlet tube into a vessel containing the vapour or dust of the flame colouring substances.

J. V. E.

Polarimetric Measurements with Small Quantities of Liquid. JULIUS DONAU (*Monatsh.*, 1908, **29**, 333—336).—In the experiments in question, a capillary tube of 0·4—0·5 mm. internal diameter and 5—10 cm. long, made of black glass, was fixed by means of rubber tubing into a wider tube; the liquid to be examined was then introduced, the ends closed with small glass covers, the tube pushed inside an ordinary polarimeter tube, and the measurements made in the usual way. Sodium light or, for the longer tubes, electric light is used, and the results are scarcely less accurate than those obtained in the ordinary method (compare Fischer, this vol., i, 544). G. S.

Dispersion of Magnetic Rotatory Power in the Neighbourhood of Bands of Absorption in the Case of Rare Earths. JEAN BECQUEREL (*Phil. Mag.*, 1908, [vi], **16**, 153—161. Compare Abstr., 1906, ii, 317, 421; 1907, ii, 147; this vol., ii, 78, 338).—In reference to recent communications of Wood (this vol., ii, 244) and Elias (this vol., ii, 549), the author discusses the results of his work on the influence of a magnetic field on the absorption bands of xenotime and tysonite, details of which have already been published.

It is maintained that the experimental observations are in agreement with the theory of magnetic rotatory polarisation, which is based on the Hall effect. The phenomenon in the case of crystalline substances is of the same nature as that found by Zeeman for vapours.

Differences are found in that the order of magnitude of the displacements for many of the bands of crystals is much greater than for the bands of vapours, and that when the optic axis of a uniaxial crystal is parallel to the lines of force of the field and the direction of propagation of the light, the bands corresponding with the absorption of the circular components of given sense are not all displaced in the same direction.

H. M. D

Photographic Capacity and Supposed Radioactivity of Hydrogen Peroxide. OCTAVE DONY-HÉNAULT and ALICE DONY-HENAULT (*Bull. Soc. chim. Belg.*, 1908, **22**, 224—245. Compare Abstr., 1906, ii, 645).—The results of this work show that Russell's view, that the latent images produced by various organic materials when placed on sensitised plates in the dark are due to the action of vapour of hydrogen peroxide directly evolved by these materials, is accurate, and that the action is not due to radiation, as suggested by Graetz (*Physikal. Zeit.*, 1904, 5, 698).

The vapour tensions of solutions of hydrogen peroxide have been ascertained by determining the amount of the peroxide carried away in a certain time by a known current of gas from a solution of the peroxide of known strength kept at a definite temperature. The peroxide was absorbed in a solution of titanic anhydride in sulphuric acid, and finally estimated by a standard solution of permanganate. At constant temperature, the vapour tension of hydrogen peroxide solution increases with the concentration, but for equal concentrations the partial vapour pressure may diminish with rise of temperature; thus a solution may give more water vapour and less hydrogen peroxide vapour at 40° than at 19° (compare Precht and Otsuki, Abstr., 1905, ii, 296, 495). The vapour tensions observed are tabulated in detail in the original. The minimum quantity of hydrogen peroxide necessary to produce an image on a photographic plate is $1{\cdot}2 \times 10^{-8}$ gram. The vapour tension and photographic activity of hydrogen peroxide solution may be either increased or diminished by the addition of sulphuric acid, and, generally, parallel observations are concordant, but influences sometimes disturbing this concordance are (1) the slow interaction of the acid and peroxide, causing the vapour tension to vary with the duration of the experiment, and (2) the effect of increased humidity in intensifying the image on the plate.

From these observations, the conclusion is drawn that the photographic activity of solution of hydrogen peroxide is due to the actual transport of peroxide vapour to the sensitised layer of the plate. Incidentally, it is pointed out that the photographic method may be applied to the determination of the molecular structure of the unstable compounds of titanic anhydride and other oxides with hydrogen peroxide by noting the concentration of peroxide at which the solutions of the anhydride and peroxide in sulphuric acid begin to affect photographic plates, this being the point at which the anhydride has been saturated with peroxide. Results of such experiments indicate that the compounds TiO_2,H_2O_2 and $MoO_3,2H_2O_2$ exist, which are stable in sulphuric acid solution. T. A. H.

Radioactivity of Ordinary Metals and the Penetrating Radiation from the Earth. J. C. McLennan (*Physikal. Zeitsch.*, 1908, 9, 440—443).—The electrical conductivity of the air enclosed in cylinders of lead, aluminium, and zinc has been measured at a number of places in the neighbourhood of Toronto. The collected data lead the author to draw the conclusion that if the metals could be entirely freed from radioactive impurities, and if observations could be made under conditions such that penetrating radiations from external sources could be excluded, the conductivity of the enclosed air would have an extremely small value, and might disappear completely. H. M. D.

Helium and Radioactivity in Rare and Common Minerals. ROBERT J. STRUTT (*Proc. Roy. Soc.*, 1908, **80**, *A*, 572—594).—A large number of minerals, including sulphides, native elements and oxides, rare earth minerals, and igneous rocks, have been tested for the inert gases, more particularly helium. The general method of procedure was to heat the finely-powdered mineral to redness, absorb the ordinary gases given off, and examine the spectrum of the inert residue.

Practically all the minerals contain helium, and in the majority of cases in the proportion to be expected from the traces of uranium and radium which the minerals contain. Thus for samarskite, hæmatite, and quartz, which contain 1,500,000, 700, and 2 c.mm. of helium per kilogram respectively, the ratio of helium to uranium oxide varies only from 9 : 1 to 14 : 1. In a few cases in which the ratio is higher, the mineral contains thorium, apparently in sufficient amount to account for the greater helium content. The only exception to the above statements is beryl, which yields a proportion of helium much greater than corresponds with the amount of radioactive substance present.

The only minerals which contain appreciable amounts of argon are igneous rocks, and there does not appear to be any connexion between the radioactivity and the proportion of argon present. The results, therefore, afford no evidence that argon is one of the products of radioactive change. G. S.

Radioactivity of Mineral Springs in the Tyrol. MAX BAMBERGER (*Monatsh.*, 1908, **29**, 317—332).—The measurements were made by Engler's method (Abstr., 1907, ii, 218). The temperature and the radioactivity (in electrostatic units) of the water from a large number of wells are given in tabular form, as well as some geological notes on the localities. The radioactivity of sediments from four of the wells has also been determined. G. S.

Radium Content of Deep-Sea Sediments. JOHN JOLY (*Phil. Mag.*, 1908, [vi], **16**, 190—197).—The author has examined the radioactivity of deep-sea sediments obtained from the "Challenger" and "Albatross" collections, and, further, of a specimen of Globigerina Ooze, and one of the mud thrown up by the volcanic disturbance of 1906 in the Bay of Bengal. These sediments are very much richer in radium than average terrestrial rocks. The richest sediments are those from the most central parts of the Pacific Ocean. Comparing the amounts of radium and calcium carbonate in the deposits, it is found that as the former increases, the latter decreases. This indicates that the amount of radium increases with the antiquity of the sediment. The largest amount of radium found was in the red clay from the Challenger Station, 276 ; per gram of air-dried material it contains $52{\cdot}6 \times 10^{-12}$ gram radium. Uranium has been found to be present in this red clay ; a colorimetric determination of the amount present in the 8·42 grams examined gave 0·0006 to 0·0007 gram, whereas the amount calculated from the radium content is 0·0012 gram. H. M. D.

Influence of Temperature on Radioactive Changes. WILHELM ENGLER (*Ann. Physik.*, 1908, [iv], **26**, 483—520. Compare Curie and Danne, Abstr., 1904, ii, 306; Bronson, Abstr., 1905, ii, 567; Makower, Abstr., 1906, ii, 259; Makower and Russ, Abstr., 1907, ii, 421; this vol., ii, 449; Schmidt, this vol., ii, 141).—A further attempt to settle the question whether the rate of decay of radioactive substances is independent of the temperature. The measurements were made on radium *B* and *C* and on radium emanation, the experiments being so arranged that the rate of decay could be measured during the period of heating and also immediately afterwards.

The observations with radium *B* and *C* indicate definitely that the rate of decay at 1100° to 1400° is greater than at the ordinary temperature, whilst, after cooling, the rate of decay is for some time less than the normal value. The influence of temperature on the rate of decay increases with the temperature.

In a similar way, when radium emanation is heated to temperatures above 1100°, an increase in the activity amounting to several units per cent. is observed. Even after heating for several hours, the activity is considerably greater than at the ordinary temperature. On cooling, the activity falls, and the normal value is attained at the end of about an hour. This decrease in the activity on cooling was not observed in all the experiments, and the suggestion is made that the samples of emanation which show the phenomenon contain another substance which is very sensitive to rise of temperature. This substance is apparently formed very slowly, for the emanation collected after a period of rest of eighteen weeks showed no decrease in activity on being cooled after exposure to a higher temperature.

H. M. D.

Secondary β-Rays. JOHN A. MCCLELLAND (*Proc. Roy Soc.*, 1908, **80**, *A*, 501—515. Compare Abstr., 1907, ii, 420).—When radiation from radium, consisting of 96% of β-rays and 4% of γ-rays, is allowed to impinge on plates of various metals, the secondary radiation from the metal consists entirely of β-rays.

Although secondary β-rays are emitted in all directions, a very large proportion follows the ordinary law of reflection. The intensity of the reflected beam of β-rays does not vary much when one metal is substituted for another, but the intensity of the true secondary β-radiation, free from reflected rays, depends on the atomic weight of the metal in an even more striking manner than was shown in the previous work. If the amounts of true secondary radiation are plotted against atomic weights, the elements fall into divisions corresponding with the chemical periods. The higher the atomic weight the greater is the amount of β-radiation emitted, and the less the relative importance of the reflected portion.

Experiments were made in which the angle of incidence of the primary radium rays on the plate was 0°, 30°, 45°, 60°, and 75°, whilst the intensity of the emitted radiation was measured at all angles in the plane of incidence up to 75° on each side of the normal to the surface. When the incidence is normal to the surface, the secondary radiation in any direction is proportional to the cosine of the angle between that direction and the normal. This might be expected from the fact that radiation from an element of volume deep in the plate traverses a thickness of material which is inversely proportional to the cosine of the angle between its direction and the normal.

Secondary radiation is much less from a thin sheet of aluminium than from a thick one, but the reflected portion increases less rapidly than the total radiation when the thickness of the plate is increased. Reflection is not merely a surface action, but goes on at successive layers beneath the surface.

There is good ground for dividing the total secondary radiation into two distinct parts, since true secondary β-rays appear to be more readily absorbed by tinfoil than either reflected or primary β-rays.

In addition to secondary radiation in the plane of incidence, the total radiation from an exposed plate has been measured by placing the plate at the base of an ionisation vessel consisting of three concentric tinfoil hemispheres. The ionisation current from the outer and inner to the middle hemisphere was approximately proportional to the total radiation, however distributed.

Measurements were made with lead, tin, copper, and aluminium, the angles of incidence varying from 10° to 80° to the normal. Given equal amounts of primary radiation falling on the plate, the total secondary radiation appears to vary somewhat with the angle of incidence. The higher the atomic weight the greater the total secondary radiation. With low atomic weights, reflected rays are an important factor, and the author supposes that these are not confined to the plane of incidence.

Reflected β-rays are supposed to actually consist of some of the incident β-particles, whilst true secondary radiation more probably consists of particles expelled from atoms perturbed by the entry of primary rays. The expelled particles may be original constituents of the atom or incident particles previously absorbed by the atom.

R. J. C.

Decay of Radium Emanation when Dissolved in Water. Richard B. Moore (*Proc. Roy. Soc.*, 1908, **80**, *A*, 597—598).—The half-time period for the decay of radium emanation dissolved in water is 3·8 days, practically identical with that observed under ordinary conditions in air.

G. S.

Condensation of Radioactive Emanations. E. Henriot (*Chem. Zentr.*, 1908, **1**, 1515—1516; from *Le Radium*, 1908, **5**, 41—46).—With the object of ascertaining whether there is any relationship between the condensation of radium and thorium emanations by cooling and their adsorption by solids when heated, the adsorption of radium emanations by cocoanut charcoal has been studied. This substance was first treated in the cold with emanation, then heated in a closed vessel to a definite temperature, and the vessel connected with a larger evacuated chamber. The quantity of emanation thereby given up was measured and found to be a regular function of the temperature; at 18° it is practically zero, and at 350° complete. When actinium emanation was connected by a U-tube to a zinc sulphide screen and the whole apparatus evacuated, no scintillations were produced when the temperature of the U-tube was below $-145°$, but with an increase of temperature an increased luminosity was observed. In a similar manner, it was found that radium emanation produced luminosity above $-150°$ to $-160°$. An actinium salt was itself cooled, and the emanation conducted to a condenser by a current of air and measured; it was found that above $-140°$ the quantity of emanation produced increased with the temperature. J. V. E.

Condensation of the Actinium and Thorium Emanations. S. Kinoshita (*Phil. Mag.*, 1908, [vi], **16**, 121—131).—A comparison of the condensation phenomena of the emanations of thorium and actinium has been made by a method similar to that used by Rutherford and Soddy for radium and thorium emanations (compare *ibid.*, 1903, [vi], **5**, 361). Actinium emanation begins to condense at $-120°$, but until the temperature falls to $-150°$ the condensation is incomplete. The temperature at which condensation begins, or at which a given proportion of the emanation remains uncondensed, depends largely on the pressure; it is the same whether the emanation is conveyed by air or by hydrogen.

Experiments on thorium emanation made with the same apparatus show that it condenses at temperatures from 2—3° higher than the actinium emanation. The influence of pressure on the condensation phenomena is very nearly the same for both. H. M. D.

Emission of Electrons by Heated Metallic Oxides. Felix Jentzsch (*Ber. deut. phys. Ges.*, 1908, **6**, 398—400. Compare Deininger, this vol., ii, 83).—The author has measured the number of electrons emitted by twenty different metallic oxides at high temperatures.

Platinum wires, coated with the oxides, were heated electrically and suspended axially in a brass cylinder between which and the oxide-coated wire a difference of potential was established, and the saturation current was measured. In all cases, the formula deduced by Richardson (*Phil. Trans.*, 1903, *A*, 201, 516) is satisfied by the experimental data.

Values representing (1) the number of electrons contained in unit volume of the emitting substance, and (2) the work done by an electron in passing through the surface of the active substance, are tabulated for the various oxides examined. The work done by an electron on emission is greater for the oxides of the electropositive metals than for those of the electronegative metals. On the other hand, the number of free electrons in the electropositive metals exceeds that in the electronegative. H. M. D.

Changes of Pressure which Accompany Point Discharge through Hydrogen containing Oxygen and Nitrogen. A. P. Chattock and A. M. Tyndall (*Phil. Mag.*, 1908, [vi], **16**, 24—47).—Experiments have been made to ascertain the molecular complexity of the ions in point discharge through hydrogen. By discharging from a platinum point against a platinum or palladium plate, the ions appear to be absorbed by the plate, resulting in a diminution of pressure, from which the number of molecules removed from the gas per ion can be calculated when the quantity of electricity passing through the gas during the discharge is known. (The expression "per ion" is to be interpreted as "per hydrogen atom set free in a voltameter placed in series with the discharge vessel.") The pressure changes were measured by means of a sensitive tilting pressure gauge capable of indicating differences of the order of $1 \cdot 10^{-8}$ atmosphere.

In pure hydrogen, the pressure change corresponds with the removal of one molecule per ion. In hydrogen containing 2 to 14% by volume of oxygen, positive point discharge brings about the combination of about 16 molecules of oxygen per ion, whilst negative discharge causes about 25 molecules of oxygen to combine per ion. When the percentage of the oxygen is less than 0·2, the number of molecules which combine in the positive discharge is approximately constant, and equal to about 10 per ion. For negative discharge, the combination increases rapidly when the percentage of oxygen falls below 2, and in hydrogen containing less than 0·01% of oxygen it attains the high value of 110 molecules per ion.

The presence of one part of oxygen in ten million parts of hydrogen can be detected by means of the pressure changes which accompany the point discharge.

When nitrogen is present with oxygen in hydrogen, even in large excess, the combination which takes place is chiefly, and perhaps entirely, between the oxygen and the hydrogen. H. M. D.

Does the Law of the Action of Mass Hold for the Silent Electrical Discharge? MAX LE BLANC and JOHN H. DAVIES (*Zeitsch. Elektrochem.*, 1908, **14**, 361—366).—When dry ammonia gas is exposed to the silent discharge at constant temperature and constant current, the rate of decomposition is nearly proportional to the pressure. Temperature has a comparatively small influence on the rate of decomposition; a rise of 100° nearly doubles it. An increase of the current of one-third nearly doubles the rate of decomposition. The presence of excess of hydrogen diminishes the rate of decomposition, whereas nitrogen increases it. The luminosity of the discharge is much increased by nitrogen, but not by hydrogen. The final condition of equilibrium attained is found to be very little affected by the strength of current used. The ratio $[N_2][H_2]^3/[NH_3]^2$ for different mixtures of hydrogen and nitrogen is not even roughly constant. The law of mass action therefore does not hold. Apparently, it is only true when the temperature is so high that the reactions occur under the influence of heat alone. T. E.

Volatilisation of Cathodes in Attenuated Gases. FRANZ FISCHER and OTTO HÄHNEL (*Zeitsch. Elektrochem.*, 1908, **14**, 366—367). —The authors have compared the volatilisation of different cathodes with the same current by using two discharge tubes in series. With the same metal and gas, the volatilisation is approximately inversely proportional to the gas pressure and directly proportional to the square of the current density. The volatilisation in argon and hydrogen is the same; it is less in air than in hydrogen. The order of volatility of the metals is aluminium, iron, nickel, copper, platinum, silver. If the tubes are in parallel, the current passes more readily through argon than hydrogen, and the volatilisation in the argon tube is greater. Kohlschütter and Goldschmidt (this vol., ii, 457) find that different gases favour volatilisation in the order of their atomic weights. This is not in agreement with the present experiments, and is also contradicted by Kohlschütter and Goldschmidt's results when these are calculated for equal quantities of electricity. T. E.

Electrocapillary Measurements by the Method of Large Drops. Léon G. Gouy (*Compt. rend.*, 1908, **146**, 1374—1376).—The present paper deals with absolute measurements by means of a modified capillary electrometer. In order to obtain a rigorously hemispherical drop, the mercury is contained in a glass vessel, optically worked, and of 40 mm. radius. Results are given for solutions of hydrogen sulphate, sodium sulphate, hydrogen chloride, potassium bromide, and potassium iodide. W. O. W.

Determination of the Dielectric Constant of Helium. Ernst Hochheim (*Ber. deut. phys. Ges.*, 1908, **6**, 446—448).—The author has measured the dielectric constant of helium by the electrostatic null-method of Hopkinson-Lebedeff. The mean value reduced to 0° and 760 mm. pressure is $D = 1{\cdot}000074 \pm 0{\cdot}000004$. If the mean value n of the refractive index of helium is taken from the measurements of Scheel and Schmidt, Ramsay and Travers, and of Rayleigh, the relationship of Maxwell, $D = n^2$, is found to be satisfied. H. M. D.

Electrical Conductivity of Solid Cuprous Iodide. Karl Bädeker and E. Pauli (*Physikal. Zeitsch.*, 1908, **9**, 431).—The electrical conductivity of cuprous iodide, which is abnormally high for a transparent substance, is found to diminish with time. By subjecting a very thin film of copper to the action of iodine vapour in a suitable apparatus, an initial maximum specific resistance equal to 0·01 ohm. was obtained for the iodide. In an atmosphere saturated with iodine vapour, the conductivity remains unchanged, but falls immediately when the iodine vapour is removed by a current of hydrogen or air. On saturating again with iodine vapour, the original high value of the conductivity is attained, and the transformation can be repeated with the same specimen of cuprous iodide as often as desired. H. M. D.

A Peculiar Type of Electrical Conductivity. Karl Bädeker (*Physikal. Zeitsch.*, 1908, **9**, 431—433. Compare preceding abstract).—The rise of the electrical conductivity of cuprous iodide which is observed when the substance is brought into contact with saturated iodine vapour or a saturated iodine solution takes place asymptotically; approximately four-fifths of the total increase is observed in the first minute. The increase in the conductivity is accompanied by a slight darkening of the colour and by an increase in weight. The maximum increase in weight of the substance when in an atmosphere of iodine corresponds with the addition of 0·00333 gram of iodine per gram of cuprous iodide. The proportion of absorbed iodine depends on the temperature and also on the pressure of the iodine vapour, or on the concentration of the iodine in the solution with which the cuprous iodide is in contact. Extremely small iodine vapour pressures or concentrations are, however, very active. The conclusion is drawn that the conductivity induced by the absorption of iodine is metallic in nature; the resistance is the same whether measured by direct or alternating currents, and prolonged passage of a direct current produces no change in the conductivity. The increase in conductivity observed when cuprous iodide is acted on by light is attributed to the separation of traces of iodine. H. M. D.

Binary Electrodes and Electrochemical Adsorption. LEONOR MICHAELIS (*Zeitsch. Elektrochem.*, 1908, **14**, 353—355).—By a binary electrode the author means a substance which sends out positive and negative ions when it dissolves. An acid of small solubility and high molecular weight sends out hydrogen ions and also anions; it may possibly continue to send these out after the solution is saturated; the ions will re-combine, and the undissociated molecules produced will separate out in the solid form. Owing to the different rates of diffusion of the hydrogen ions and the anions, the former will tend to escape from the surface of the solid, leaving it negatively charged. It therefore behaves like a hydrogen electrode, and the difference of potential between it and the solution depends on the concentration of the hydrogen ions in the solution. The addition of an acid diminishes the potential difference, and therefore increases the surface tension of the solid particles. The precipitation of a suspension of mastic by acids is explained in this way. The precipitation by a basic colouring matter, such as methyl-violet, is explained by the formation of a salt on the surface of the mastic particles. This diminishes the tendency to send out hydrogen ions, and so diminishes the potential difference and increases the surface tension. This theory is the opposite of that which explains adsorption as a pure surface effect due to the tendency of all substances to take on the form with the smallest surface tension.

T. E.

Thermodynamics of Liquid Cells. P. HENDERSON (*Zeitsch. physikal. Chem.*, 1908, **63**, 325—345. Compare Abstr., 1907, ii, 426). —The formula deduced in the earlier paper (*loc. cit.*) has been tested by measurements of the *P.D.* between equally concentrated solutions containing bivalent ions, such as SO_4'', Ba, Cd, &c. The agreement between the observed and calculated values is fair. In respect to ease of manipulation, the author's formula is superior to Planck's, and the results which it gives are quite as satisfactory. An extension of the formula to concentrated solutions is deduced, and tested by measurements of the *E.M.F.* of the cell:

$$\mathrm{Ag,AgCl}\left|\begin{array}{c}\text{Conc. HCl solution}\\ \text{Sat. PbCl}_2\text{ solution}\end{array}\right|\begin{array}{c}\text{Sat.}\\ \text{PbCl}_2\text{ solution}\end{array}\left|\,\mathrm{AgCl,Ag.}\right.$$

J. C. P.

Change of Free Energy Accompanying the Formation of Some Fused Salts of the Heavy Metals. RICHARD LORENZ and M. G. FOX (*Zeitsch. physikal. Chem.*, 1908, **63**, 109—120).—The authors describe a form of chlorine or bromine electrode suitable for use at high temperatures, consisting of a hollow carbon tube kept charged with the halogen, and show that this electrode is reversible. The variation of *E.M.F.* with temperature has been determined for a number of cells containing fused salts, and the results are represented by the following formulæ: in these e_{AB} means the *E.M.F.* of the cell $A \mid AB \mid B$, AB being the fused salt formed from the elements A and B.

$e_{PbCl_2} = 1{\cdot}263 - 0{\cdot}000679\ (t - 498°)$ for the temperature-interval 498—660°: $e_{CdCl_2} = 1{\cdot}258 - 0{\cdot}000750\ (t - 560°)$, valid between 560° and 740°; $e_{PbBr_2} = 1{\cdot}0945 - 0{\cdot}000714\ (t - 367°)$, valid between 367° and 640°; $e_{CdBr_2} = 1{\cdot}045 - 0{\cdot}000742\ (t - 580°)$, valid between 580° and 720°. J. C. P.

Thermodynamics of Cells with Fused Electrolytes. RICHARD LORENZ and M. G. FOX (*Zeitsch. physikal. Chem.*, 1908, **63**, 121—125. Compare preceding abstract).—The Gibbs-Helmholtz formula is applied to the cells referred to in the preceding abstract, and the heats of formation of lead chloride and bromide and cadmium chloride and bromide are calculated. The values so found for the four salts are respectively 82·4, 71·5, 86·8, and 77·3 Cal. These figures represent the heats of formation at constant pressure in the temperature-intervals recorded in the previous abstract. So far as comparison is possible, the agreement with the values deduced thermochemically is fair. J. C. P.

Differences of Potential at the Contact of Two Electrolytes. Nernst's Theory. J. GUYOT (*J. Chim. Phys.*, 1908, **6**, 424—491).—Although the general formulæ for the potential difference at the contact of two electrolytes have not yet been obtained, it is shown theoretically that the calculation is not only possible for binary electrolytes with univalent ions (Nernst, Planck), but also for any two electrolytes of the same type (for example, $BaCl_2$, $CaCl_2$), as well as for electrolytes with a common ion when the total ionic concentration is the same for the two solutions. Direct experimental verification of the formulæ is not possible, owing to the fact that no single potential difference is known with accuracy; in particular, it is pointed out that the Helmholtz-Ostwald method for determining single potential differences, depending on electrocapillary phenomena, is not trustworthy.

Measurements have therefore been made with "liquid chains," in which two solutions are in contact with each other and with mercury electrodes, forming cells of the type $M|S_1|S_2|M$. The total *E.M.F.* of such a cell is the algebraic sum of the potential differences at the two junctions metal|solutions, and that at the junction of the two solutions $S_1|S_2$. As the former can be calculated for electrodes of the same metal by the usual formula $E = RT/nF\log_e p_1/p_2$, the *E.M.F.* $S_1|S_2$ is readily obtained. For solutions of salts of the same type, measurements were made with alkali sulphates against sulphuric acid and against each other, and for solutions of salts of different types such couples as $HCl|BaCl_2$, $H_2SO_4|CuSO_4$, and $Na_2SO_4|ZnSO_4$ were used. A few measurements were also made with liquid chains with identical extremities, for example,

$0{\cdot}1N K_2SO_4|0{\cdot}2N Li_2SO_4$ and $0{\cdot}02N H_2SO_4|0{\cdot}1N K_2SO_4$,

the *E.M.F.*'s at the junction metal|solution being thus eliminated. In all cases, the observed and calculated values were in satisfactory agreement. G. S.

A Method for the Calculation of Ionic Concentrations from Measurements of Potential in Concentration Cells. Warren Kendall Lewis (*Zeitsch. physikal. Chem.*, 1908, **63**, 171—176).—A method is given for calculating the dissociation of an electrolyte from potential measurements in concentration cells. Applied to the experimental determinations of Cumming with silver nitrate (this vol., ii, 253), very close agreement is obtained. New determinations with lead nitrate and chlorate are also given, the value for the normal lead electrode obtained being 0·402. The advantage of the method in the case of multivalent ions is that it is unnecessary to make any assumption as to dissociation in successive stages. C. H. D.

Electrochemical Equivalent of Silver, Especially in Reference to the So-Called Anode Liquid. Friedrich Kohlrausch (*Ann. Physik*, 1908, [iv], **26**, 580—596).—The author has made experiments to ascertain whether the value obtained for the electrochemical equivalent of silver by F. and W. Kohlrausch in 1881, and 1883, requires correction in the light of recent researches on the properties of the anode-liquid. According to these, oxidation products are formed in the solution at the anode, and this leads to inaccurate values for the equivalent. Using the original pieces of apparatus and duplicates of these, the new experiments show that the arrangement of the electrodes is such that the abnormal properties of the anode-liquid do not exert any influence on the result obtained. The correction which might be applied to the value 0·01183 given by the older experiments is at any rate less than 0·002%. H. M. D.

A Lecture Voltameter. R. Pitoni (*Nuovo Cim.*, 1908, [v], **15**, 426—428).—The voltameter is of the Hofmann pattern, but the three tubes are of equal diameter and in the same plane. Each is fitted with an electrode, and the centre tube also has an outlet tube and tap at the lower end. In the electrolysis of water, the central electrode may be made the anode, and the two outer ones cathodes; the volume of gas collected in each tube is then equal. The application of the voltameter to polarisation experiments is also described.

C. H. D.

Relation between the Ionising Power and the Dielectric Constants of Solvents. Herbert N. McCoy (*J. Amer. Chem. Soc.*, 1908, **30**, 1074—1077).—Walden has shown (Abstr., 1906, ii, 149) that when solutions of an electrolyte in various solvents have the same degree of dissociation, the product of the dielectric constant and the cube root of the dilution for such solutions is a constant, or $\epsilon\sqrt[3]{V}=$ const. Kohlrausch's equation $\Lambda=\Lambda_{\infty}-k\sqrt[3]{C}$, where Λ is the equivalent conductivity at concentration C, Λ_{∞} the conductivity at infinite dilution, and k is a constant, may be written $\Lambda/\Lambda_{\infty}=1-k/\Lambda_{\infty}\sqrt[3]{C}$ or $\alpha=1-K\sqrt[3]{C}$ (1), where the degree of ionisation $\alpha=\Lambda/\Lambda_{\infty}$ and $k/\Lambda_{\infty}=K$, a constant. From equation (1) the expression $K=(1-\alpha)\sqrt[3]{V}$ (2) is obtained. The data for sodium chloride are tabulated, in which the values of α are calculated by equation (1). Similar calculations have been made for about thirty other salts. The differences between the observed and calculated values of α do not exceed the probable experimental error. It is shown that equation (1) applies fairly accurately to many solutions in inorganic solvents, and the values of $K=(1-\alpha)\sqrt[3]{V}$, ϵ, and $K\epsilon$ for tetraethylammonium iodide in various solvents are calculated from Walden's data. The results are also given for potassium iodide in water, ethyl alcohol, and acetonitrile, and for lithium nitrate in water, methyl alcohol, and 50% methyl alcohol. In the case of potassium iodide, the value of $K\epsilon$ is nearly the same for ethyl alcohol as for water, but is abnormally large in acetonitrile. For lithium nitrate, $K\epsilon$ has the same value for water and for methyl alcohol. E. G.

Electrolytic Rectification of Alternating Currents. GÜNTHER SCHULZE (*Zeitsch. Elektrochem.*, 1908, **14**, 333—347).—The author's experiments with direct current (*Ann. Physik*, 1906, **21**, 929; 1907, **22**, 543; **23**, 226; **24**, 43; 1908, **25**, 775) have shown that the active electrode in an electrolytic rectifier is covered with a porous, non-conducting skin. The pores next to the metal are filled with gas, and the remainder are full of the electrolyte. When the electrode is cathode, negative corpuscles pass from it through the gas layer to the electrolyte without much resistance; when the electrode is anode, however, the carriers of the current in the electrolyte are anions which cannot pass through the gas layer. In the anode direction, the gas layer has a resistance of the order of 500 ohms per sq. decimetre; it also has a capacity of the order of 5 microfarads per sq. decimetre, and with alternating current of 50 periods per second, this allows the same current to pass as a resistance of 640 ohms. The resistance of the electrolyte is negligible compared with this, so that the current in the anode direction is conditioned by the resistance and capacity of the gas layer. In the cathode direction, the resistance of the gas layer and of the electrolyte are each of the order of 10 ohms per sq. decimetre; the capacity of the gas layer is therefore negligible. The theoretical shape of the current and *E.M.F.* curves are deduced from these considerations. A large number of curves are taken by means of an oscillograph, using electrodes of all the active metals known. The curves agree well with the theoretical forms. As a criterion of the relative values of the cells, the ratio of their apparent resistances in the cathode and anode directions is used. With aluminium in solutions of salts of potassium or sodium, the ratio is small, but the active layer soon breaks down. The danger of breakdown is smaller with ammonium salts, but the ratio is larger. Breakdown is never observed with tantalum, but the ratio is much too large; its ability to resist *E.M.F.*'s of 1000 volts is of no use in practice, because of the very dilute solutions required. Magnesium has a very small ratio of resistances, but the active layer is very sensitive to rise of temperature. Since the liability to breakdown and a small ratio of resistances appear to be both due to the same cause (solubility of the solid skin in the electrolyte), it is improbable that a satisfactory electrolytic rectifier will be discovered. T. E.

Theory of Dulong and Petit's Law. II. Franz Richarz (*Zeitsch. anorg. Chem.*, 1908, **59**, 146—160. Compare this vol., ii, 562).—A theoretical discussion of the causes which lead to deviations from Dulong and Petit's law. The author's theory, which requires that the product of the atomic weight and the specific heat at constant volume should be equal to 6·012, cannot be tested directly by ordinary experimental data. That elements of small atomic weight and small atomic volume represent exceptions is anticipated by the author's theory. In accordance with this, it is also found that of two allotropic modifications, the one with the smaller atomic volume has the smaller specific heat. H. M. D.

Equation of Condition for Metals. Max Thiesen (*Ber. deut. phys. Ges.*, 1908, **6**, 410—415, 415—417. Compare Grüneisen, this vol., ii, 563).—A discussion of conclusions regarding the equation of condition, which may be drawn from the relationship pointed out by Grüneisen, that for a number of metals the quotient of the coefficient of expansion by the specific heat is almost independent of the temperature. The significance of this relationship depends on whether the equation of condition for a solid, crystalline substance is different from the equation for the same substance in the liquid condition or in another crystalline form, or whether the same equation of condition holds for all forms of the substance. In the first case, the relationship may be strictly true for certain crystalline forms, but in the second case the relationship can only be regarded as approximately valid for a finite portion of the curve of condition. H. M. D.

Specific Heat and Molecular Magnetic Field of Ferromagnetic Substances. Pierre Weiss and Paul N. Beck (*Arch. Sci. phys. nat.*, 1908, iv, **25**, 529—548).—The energy transfer when ferromagnetic substances are magnetised or demagnetised by alterations in temperature is of the same order as the energy required to effect the temperature change itself.

The authors endeavour to show that the anomalies exhibited by the specific heats of magnetic metals (Pionchon, Abstr., 1887, 201) can be quantitatively explained as due to variations in the magnetic energy content.

Assuming each molecule to be a magnet producing lines of force, the energy of complete demagnetisation of iron is calculated to be 16·8 cal. per gram at 20°, becoming less as the temperature rises, and finally disappearing at 753°, at which temperature the iron loses its magnetic properties. The energy of demagnetisation of nickel varies from 4·3 cal. at 22·9° to zero at 376°, whilst the corresponding values for magnetite are 14·4 cal. at 15·2° and zero at 588°.

At the ordinary temperature the magnetic phenomena should account for one-twentieth of the specific heat of iron, whilst in the neighbourhood of 753° the proportion would be as much as 43%. Thus the specific heat of iron undergoes an abrupt diminution at 753°.

Calorimetric measurements of the specific heat of iron, nickel, and magnetite over a wide range of temperatures show striking agreement with the results calculated from the magnetic properties. The specific heat of iron alters by 0·112 at 758°, whereas the figures calculated from the magnetic properties are 0·136 at 753°. Values for nickel and magnetite are in still better agreement with the theory.

R. J. C.

The Solid State. W. A. Kurbatoff (*J. Chim. Phys.*, 1908, **6**, 337—354).—The melting points and equal fractions of the absolute melting points are to be regarded as corresponding temperatures for solids. It is shown by an examination of the available experimental data that at such temperatures the electrical conductivities, divided by the conductivities at the melting points, are equal for different metals, and that both electrical and thermal conductivity are periodic functions of the atomic weight. At corresponding temperatures, the law of Dulong and Petit holds rigorously, even for boron, carbon, and silicon. The evidence indicates that the molecules of solid metals are monatomic, those of solid non-metals being more complex. The molecules of sulphides, oxides, and other compounds with metallic lustre are non-associated.

C. H. D.

The Heat-contents of Binary Systems. Gustav Tammann (*Zeitsch. physikal. Chem.*, 1908, **63**, 129—140).—The thermal equilibrium of binary mixtures may be represented advantageously by means of a three-dimensional model. The ordinary temperature-concentration diagram is used as the base of the model, and perpendiculars are then erected, the heights of which are proportional to the heat-content of unit mass, the upper surfaces then being constructed by means of these perpendiculars. Sections perpendicular to the concentration axis give the variation of heat-content with temperature for a given composition. Photographs of a number of such models, with the corresponding temperature-concentration diagrams, are given for each of the cases discussed by Roozeboom.

In order to construct the model, cooling curves of the mixtures must be taken under similar cooling conditions, and the duration of each arrest determined, as in Tammann's method of thermal analysis (Abstr., 1904, 113).

C. H. D.

Correction of the Ideal Melting-point Curves of Binary Alloys. Domenico Mazzotto (*Nuovo Cim.*, 1908, [v], **15**, 401—422).—The author applies two corrections to the ideal melting-point curve, one depending on the heat of mixture, and the other on the association of the dissolved metal. The data for the former correction are obtained from the author's determinations (*Rend. R. Ist. Lombardo*, 1888, [ii*a*], **18**, 165), and those for the latter from the atomic depressions measured by Heycock and Neville (Trans., 1889, **55**, 666; 1890, **57**, 376, 656, 1892, **61**, 888; 1894, **65**, 31; 1897, **71**, 383; Abstr., 1897, ii, 245). The application of these corrections to the melting points of alloys of bismuth and tin, lead and tin, and lead and bismuth, gives curves approximating very closely to the ideal curves. The method fails when the two components form a solid solution, as in the case of tin dissolved in zinc, or when chemical combination takes place, as in lead amalgams. The following coefficients of polymerisation were determined: Bi in Sn, 1·25; Bi in Pb, 2·2; Sn in Pb, 3·8; Zn in Sn, 1·15.

C. H. D.

A Cryoscope. M. C. DEKHUYZEN (*Biochem. Zeitsch.*, 1908, **11**, 345—381).—The true freezing point of a solution can be expressed by the equation $t_w = t_s + k_a/K_E.(t_s - t_c)$, where t_w is the true freezing point, t_s the apparent (actually read) freezing point, and t_c the "convergence temperature," that is, the temperature which the solution will attain when congelation does not take place. k_a is a constant depending on the rate at which the equilibrium of temperature between the freezing vessel and cooling bath is attained. K_E is a number, by means of which the rate can be calculated at which the ice in the supercooled liquid is formed or dissolved. The above formula is due to Nernst and Abegg. The constant k_a can be directly determined, the equation $-dt/dz = k_a(t - t_c)$, where z represents time, denoting the rate of temperature change of the liquid. From this equation,

$$k_a = 1/(z_2 - z_1).\text{log.nat.}(t_1 - t_c)/(t_2 - t_c),$$

where t_c represents the temperature of the cooling mixture. To determine K_E, the following formula was evolved:

$$dt/dz = K_E(t_w - t_s) - k_a(t_s - t_c).$$

A practically constant cooling bath can be obtained by applying the principles that ice and salt solution attain temperature equilibrium with very small velocity if the surface of the ice and the stirring of the liquid be reduced to the lowest possible limits.

The apparatus employed consists of an inner cooling vessel with ground flange, fitted into a somewhat large cooling vessel, also with ground flange; the two ground surfaces are clamped together. This is covered with an ebonite plate, into which fit two tubes, one of which contains mercury, for quick cooling, and the other tube is a Dewar vessel, formed from two concentric test-tubes with an evacuated space between. A special arrangement made for transferring the vessel containing the liquid under investigation (with the Beckmann thermometer) from the quick-cooling to the Dewar tube is described, and also the methods for determining the values of k_a and K_E.

S. B. S.

Boiling and Freezing Points of Concentrated Aqueous Solutions and the Question of the Hydration of the Solute. SAMUEL M. JOHNSTON (*Trans. Roy. Soc. Edin.*, 1908, **45**, Part 4, 855—884. Compare Abstr., 1906, ii, 9).—Boiling point, freezing point, and electrical conductivity data are recorded for concentrated aqueous solutions of a number of electrolytes. The conductivity measurements were made at 0° and 99·4°.

In general, the rise of the boiling point produced by one gram equivalent has a minimum value at a concentration of 0·5 to 1·0 gram equivalent per litre. For higher concentrations than that corresponding with this minimum, the rate of increase of the equivalent boiling-point elevation gradually diminishes, and in certain cases a maximum can be observed.

From a comparison of curves which represent the variation of μ_v/μ_∞ with the concentration of the dissolved electrolyte, the conclusion is drawn that the degree of ionisation is greater at 0° than at 100° in the case of dilute solutions, whereas concentrated solutions are more dissociated at the higher temperature.

Assuming that the ionisation can be obtained from conductivity data, and that the elevation of the boiling point (or depression of the freezing point) produced by a gram molecule or gram ion is independent of the concentration of the solution, the experimental data are used to calculate the degree of hydration of the dissolved electrolyte on the assumptions (1) that molecules and ions are hydrated; (2) that the ions only are hydrated, and (3) that the undissociated molecules only are hydrated. The fact that the values obtained on the first assumption are in some cases constant for a series of concentrations is regarded as evidence of hydration of both the undissociated molecules and the ions. For other electrolytes, hydration of the molecules or of the ions alone is assumed. H. M. D.

Theoretical Determination of the Vapour Pressure of Solid and Liquid Carbon Dioxide. E. Falck (*Physikal. Zeitsch.*, 1908, 9, 433—437).—The validity of Nernst's thermodynamic formula for the variation of vapour pressure with temperature has been examined for liquid carbon dioxide between −10° and −60° and for the solid between −60° and −154°. The agreement between the calculated and experimental values is very good, except in the neighbourhood of −100° to −130°. A similar deviation for an intermediate range of temperature was found by Naumann in the case of iodine.

The molecular heats of liquid and solid carbon dioxide are given by the formulæ $C_l = 3{\cdot}8 + 0{\cdot}077T$ and $C_s = 3{\cdot}8 + 0{\cdot}032T$ respectively. At all temperatures above absolute zero, liquid carbon dioxide has therefore the greater specific heat.

The free energy and the heat change for the passage of solid carbon dioxide into the liquid form at various temperatures are calculated. The curves representing these values are symmetrical and tangential to a straight line parallel to the axis of temperature. H. M. D.

Mutual Action of Dissolved Substances as Deduced from their Vapour Pressures. Adam Wroczynski (*J. Chim. Phys.*, 1908, 6, 500—504).—Remarks on Konowaloff's recent papers (Abstr., 1907, ii, 334, 602). It is shown that several of Konowaloff's formulæ can be deduced from the general Duhem-Margules formula for the vapour pressures of binary mixtures with the help of Raoult's law. It follows that, contrary to Konowaloff's view, there is no proof of chemical combination under the conditions of experiment in many of the binary mixtures studied by that author. G. S.

Vaporisation I. HANNS VON JÜPTNER (*Zeitsch. physikal. Chem.*, 1908, 63, 355—366. Compare Abstr., 1906, ii, 522; 1907, ii, 742).—The values of f calculated by the empirical equation $f=f_o-a\theta+b/(1-\theta)$ (see *loc. cit.*) are in the neighbourhood of the critical temperature greater than those derived directly from observation. The author now shows that when the third term on the right hand side of the foregoing formula is multiplied by the factor $1-\theta/[e(1-\theta)+1]$, where e is a constant, a better agreement is secured, as shown by figures for fluorobenzene, carbon dioxide, and ammonia.

By combining this modified equation with the Clapeyron-Clausius formula, an expression is obtained for the latent heat of vaporisation.

According to Mathias, $(D_l+D_v)/2D_k=2-\theta$, where D_l and D_v are the densities of liquid and saturated vapour respectively, and D_k is the critical density. The agreement between the experimental figures and the values calculated by this formula is in general very good, but, according to the author, the expression $1+a'(1-\theta)$ on the right-hand side, where a' is a constant for each substance, gives even better results, as shown by figures for fluorobenzene and ammonia. A formula is also developed for calculating the difference between the densities of liquid and saturated vapour, and is tested with satisfactory results by the available data for fluorobenzene and ammonia. Formulæ are further deduced for calculating the densities and volumes of liquid and saturated vapour in terms of θ and the various constants quoted above. J. C. P.

Sources of Error in the Ebullioscopic Method and Attempts to Remove Them. ERNST BECKMANN [With OTTO LIESCHE and THEODOR KLOPFER] (*Zeitsch. physikal. Chem.*, 1908, 63, 177—215).—An elaborate series of experiments has been made to determine the sources of possible error in ebullioscopic determinations. The influence of the external temperature is discussed, and is shown to be least for concentrated solutions; it is less than in the case of cryoscopic experiments. Direct electrical heating by means of a thin platinum spiral is very suitable for non-electrolytes, especially when the boiling point of the solvent is high. Electrolytes give abnormal results, even when an alternating current of high frequency is employed.

A method is described by which satisfactory measurements can be obtained with the bulb of the thermometer immersed only in vapour. The device employed keeps the bulb of the thermometer free from liquid, a layer of boiling liquid forming a jacket round the vapour space. In another form of apparatus, the bulb is immersed in liquid free from vapour, jacketed with the vapour from the same solution.

The influence of the nature and quantity of filling material (garnets or platinum tetrahedra) is also discussed. C. H. D.

Apparatus for Fractional Distillation under Reduced Pressure. WILHELM STEINKOPF (*Bull. Soc. chim.*, 1908, [iv], 3, 763—764).—Attention is directed to the author's apparatus for this purpose (*Chem. Zeit.*, 1902, **26**, 407), which resembles Delepine's (this vol., ii, 461), but differs in having the cylindrical receiver closed by a rubber stopper, through which the distributor, provided with a side-tube for attachment to a pump, passes. T. A. H.

Modification of the Platinum Vessel of the Berthelot-Mahler Bomb. EDUARD TÓTH (*Chem. Zeit.*, 1908, **32**, 608).—So as to minimise the wear-and-tear of the pastille, and to facilitate the arrangement of the fuse-thread, it is suggested that the bottom of the platinum vessel should be hollowed out in a pod-like form so that the fuse-thread can be introduced after weighing without disturbing the pastille.

J. V. E.

Heat of Neutralisation of Acetic and Benzoic Acids by Aniline in Benzene Solution. LÉO VIGNON and ÉVIEUX (*Compt. rend.*, 1908, **146**, 1316—1318).—The molecular heats of dissolution of acetic acid, benzoic acid, and aniline, in benzene at $M/4$ dilution are $-0{\cdot}51$ Cal., $-3{\cdot}54$ Cal., and $-1{\cdot}09$ Cal. respectively. When equal volumes of $M/4$ solutions of acetic acid and aniline are mixed, a fall of temperature (0·054°) is observed corresponding with an absorption of $-0{\cdot}16$ Cal. per molecule. On the other hand, the formation of aniline acetate directly from the acid and base results in the development of heat, whilst the heat of dissolution of aniline acetate in benzene ($M/8$ dilution) is $-3{\cdot}63$ Cal., from which the value $+1{\cdot}87$ Cal. is deduced for the molecular heat of combination of acetic acid and aniline.

Similarly, by mixing equal volumes (200 c.c.) of $M/4$ solution of benzoic acid and aniline in benzene, a very slight elevation in temperature (0·024°) is produced, corresponding with a development of 0·08 Cal. per molecule. Aniline benzoate, however, has a heat of dissolution of $-9{\cdot}4$ Cal. at $M/8$ dilution in benzene, giving the value $+4{\cdot}77$ Cal. for the heat of formation.

Determinations of the molecular weights of aniline acetate and benzoate by the cryoscopic method give the values 111 and 151—153, which more nearly agree with those calculated for mixtures of the acid and base than for the salts.

The conclusions are drawn that aniline does not combine with acetic and benzoic acids in benzene solution, and that aniline acetate and benzoate are dissociated by dissolution in benzene. E. H.

Heat of Neutralisation of Picric Acid by Different Aromatic Bases in Benzene Solution. LÉO VIGNON and ÉVIEUX (*Compt. rend.*, 1908, **147**, 67—69).—Picric acid differs from benzoic and acetic acids (preceding abstract) in that it combines with aromatic bases in benzene solution.

The molecular heat of dissolution of picric acid in benzene at 20° and $M/8$ dilution is $-3{\cdot}8$ Cal. The following are the heats of neutralisation of picric acid by various bases, and the characters of the salts formed. By aniline, $+14{\cdot}75$ Cal.; *aniline picrate* forms small, yellow crystals, of which 100 parts of water dissolve 0·54 part and 100 parts of benzene 0·078 part at 22°. *o*-Toluidine, $+16{\cdot}45$ Cal.;

o-toluidine picrate is precipitated as orange-yellow flocks, which quickly change into yellowish-white crystals. *m*-Toluidine, +15·98 Cal.; *p*-toluidine, +18·15 Cal.; m- and p-*toluidine picrates* form clear, yellow crystals. Methylaniline, +11·07 Cal. (solid salt); *methylaniline picrate* forms a golden-yellow, crystalline powder, m. p. 134°. Dimethylaniline, +14·1 Cal. (solid salt); *dimethylaniline picrate* is a granular, yellow powder, m. p. 142°. Ethylaniline, +12·6 Cal. (solid salt); *ethylaniline picrate* forms a clear yellow, crystalline powder, m. p. 132°. Dimethyl-*o*-toluidine, +9·45 Cal. (salt dissolved); the golden-yellow solution, after twenty-four hours' standing, deposits clear yellow crystals of *dimethyl-o-toluidine picrate,* m. p. 116—117°, of which 100 parts of benzene at 25° dissolve 1·35 parts. Phenylhydrazine, +19·03 Cal. (solid salt); *phenylhydrazine picrate* forms a bright yellow powder, m. p. 148—149°.

The molecular heat of dissolution of *o*-nitroaniline at 22° and $M/8$ dilution is −5·51 Cal., and its heat of neutralisation by picric acid is −0·35 Cal. The heat of dissolution of o-*nitroaniline picrate,* a brick-red, crystalline powder, in benzene at 22° and $M/16$ dilution is −8·40 Cal., whence the heat of formation in benzene solution is −1·2 Cal. A cryoscopic determination of the molecular weight in benzene solution also shows that no combination has taken place.

These results are an example of salt formation without ionisation. The electrical conductivity of the solutions either before, during, or after admixture is inappreciable.

Benzene solutions of phenol, nitrobenzene, and *m*-dinitrobenzene do not react with a benzene solution of *p*-toluidine.

The conclusions are drawn that (1) salt-formation in benzene differs from that in water, (2) that benzene having no appreciable ionising power is particularly useful for the thermal study of the formation of certain salts, (3) that the presence of several nitro-groups in the benzene nucleus greatly intensifies the acidic power of the hydroxyl group, and (4) that the acidity of picric acid becomes zero towards certain bases, such as *o*-nitroaniline.

Other acids, such as trichloroacetic acid, in which the acidic character is intensified by the presence of the three chlorine atoms, behave similarly to picric acid. E. H.

Heats of Solution of the Three Forms of Lactose. C. S. Hudson and F. C. Brown (*J. Amer. Chem. Soc.*, 1908, **30**, 960—971).—Lactose can be crystallised from solution in two forms, the monohydrate and the *β*-anhydrous modification. When the hydrate is heated at 125°, it is converted into the *a*-anhydrous form. Hudson (Abstr., 1904, i, 974) has determined the rate at which equilibrium is established between the hydrate and the *β*-modification, and the proportions of the two forms finally present. A study has now been made of the heats of solution of the three forms of lactose, keeping in view the fact that the solution of any one form is complicated by a second heat effect due to the change into the stable mixture of hydrate and *β*-form. The following terms are employed: The "initial heat of solution" is the heat produced when any form of the sugar is dissolved under such conditions that the change into the mixture of hydrate and β-form is greatly retarded. The "final heat of solution" is the total heat developed when any form of the sugar dissolves to yield a solution containing the stable mixture. The "heat of passage" of one form into the other is the heat produced when a given quantity of one form changes in solution into an equivalent quantity of the other. The final heat of solution is thus the sum of the initial heat of solution and the heat of passage. The following results have been obtained by means of calorimetric measurements.

The initial heats of solution in gram-calories are: hydrate, $-12{\cdot}0$; α-form, $+7{\cdot}3$; β-form, $-2{\cdot}3$. The final heats of solution are: hydrate, $-11{\cdot}4$; α-form, $+7{\cdot}9$; β-form, $-2{\cdot}7$. The heats of passage to the β-form are: hydrate, $+1{\cdot}0$; α-form, $+1{\cdot}0$. The equality of the heats of passage of the hydrate and the α-form support the view that in solution the α-form instantly changes into the hydrate, which is then slowly converted into the β-form. The initial heat of solution of the hydrate increases about 0·1 gram-cal. per degree rise in temperature. On diluting strong lactose solutions (0·5 molal), a slight development of heat occurs, but the heat of solution is independent of the concentration when this is less than about 0·3 molal. The pure β-form has been prepared, and has D^{20} 1·59, whilst the hydrate has D^{20} 1·54. The thermochemical data now obtained show that the crystalline substance precipitated from aqueous solutions of lactose by alcohol and ether is a mixture of the hydrate and β-modification, the two forms being present in approximately the same proportions in which they occur in stable solutions. Observations of the rotatory power of stable solutions of the sugar indicate that the hydration is slightly increased with rise of temperature from 0° to 100°. The final heat of solution of the hydrate, calculated from the solubilities at 15° and 25°, is $-11{\cdot}5$, which agrees closely with the calorimetric determination at 20°. E. G.

New Instrument for Reducing Gas Volumes to Standard Conditions. GRANT T. DAVIS (*J. Amer. Chem. Soc.*, 1908, **30**, 971—973).—An apparatus is described for so adjusting the pressure on a gas that its volume is reduced to that which it would occupy under standard conditions of temperature and pressure, calculation being thus avoided. The pressure is applied by means of a column of water, and the method is therefore only suitable for gases which can be collected over water. For details, the description and diagram in the original must be consulted. E. G.

Orthobaric Densities of Homologous Liquids. G. TER-GAZARIAN (*J. Chim. Phys.*, 1908, **6**, 492—499).—From the author's determinations of the densities and critical temperatures of acetonitrile and propionitrile, and from the corresponding determinations of Young for pentane, *iso*pentane, hexane, heptane, and octane, it is shown that the difference between the temperatures of equal densities for two homologous liquids is equal to the difference of the critical temperatures of the same liquids. Hence, if the density curve (liquid) and the critical temperature of a single member of the series is known, the density curve and critical temperature of all the other members can be calculated, if the density at a single temperature is known in each case.

The rule in question does not hold for the esters and alcohols studied by Young and Thomas (Trans., 1893, 63, 1191). G. S.

The Unit-Stere Theory: Demonstration of a Natural Relation between the Volumes of the Atoms in Compounds under Corresponding Conditions and that of Combined Hydrogen. II. GERVAISE LE BAS (*Phil. Mag.*, 1908, [vi], 16, 60—92. Compare Abstr., 1907, ii, 754).—The volume relationships of carbon and hydrogen in the liquid hydrocarbons of the olefine and acetylene series, and in aromatic and hydroaromatic compounds, have been examined in the light of the theory put forward in the earlier paper on the basis of data for the liquid normal paraffins.

At the melting point and at temperatures equally removed therefrom, the molecular volumes of the olefines may be represented by the expression: molecular volume $C_nH_{2n} = 6nS - 2{\cdot}62 = WS - (=)$. Similarly, the molecular volumes of the acetylenes are given by: molecular volume $C_nH_{2n-2} = 6nS - 2S - 3 = WS - (\equiv)$. In these expressions, S is the value of the unit-stere $= 2{\cdot}97$, W is the total number of valencies of the atoms in the hydrocarbon molecules, and the bracketed symbols represent the volume values corresponding with the unsaturated linkages.

At the boiling point, the molecular volumes of the olefines and acetylenes are given by the formulæ: molecular volume $C_nH_{2n} = 6nS$ and molecular volume $C_nH_{2n-2} = 6nS - 2S$ respectively. The value of S is approximately 3·7, but appears to vary slightly from one compound to another.

The data for aromatic compounds indicate that the atomic volumes in the nuclei are always less than the volumes of the same atoms in straight-chain molecules. The relative volumes of atoms are, however, the same in both cases. The atoms in aliphatic side-chains of aromatic compounds have the same volume as in the paraffins.

In the case of benzene and its homologues, it is shown that the critical coefficients are also subject to the valency law. H. M. D.

Torsional Elasticity of Liquids. L. LAUER and GUSTAV TAMMANN (*Zeitsch. physikal. Chem.*, 1908, 63, 141—150).—An apparatus is described by means of which a known torque of short duration could be applied to a glass sphere immersed in the liquid to be examined. The duration of the impulse varied from 0·00000163 to 0·01956 second, and was regulated and measured by means of a Helmholtz pendulum. In other experiments, a steel rod of elliptical section was substituted for the glass sphere.

The liquids investigated were water, glycerol, and undercooled betol containing 1·5% sucrose. The last two gave positive indications of torsional elasticity, increasing with falling temperature. The temperature at which elasticity becomes marked is independent of the duration of the impulse, and almost independent of the moment of torsion. This temperature is 63° for glycerol and 41° for betol. Water does not exhibit any elasticity above its melting point. C. H. D.

Weight of a Falling Drop and the Laws of Tate. Determination of Molecular Weights and Critical Temperatures of Liquids by the Aid of Drop Weights. II. J. LIVINGSTON R. MORGAN and ERIC HIGGINS (*J. Amer. Chem. Soc.*, 1908, 30, 1055—1068).—Morgan and Stevenson (this vol., ii, 356) have shown that the weight of a drop of liquid falling from the properly cut end of a glass capillary tube is proportional to the surface tension of the liquid, and can be employed for calculating the molecular weight and critical temperature.

In the present paper, an account is given of experiments which have been carried out with a bevelled tip similar to that used by Morgan and Stevenson, but attached to a burette of smaller diameter than that previously employed. The drop weights of carbon tetrachloride and the liquids studied in the earlier work have been determined at or near the temperatures at which their surface tensions have been measured by the rise of the liquids in a capillary tube. The results are tabulated. They confirm those obtained previously, and show that, for the determination of relative surface tensions, the drop-weight method is more accurate than the ordinary method depending on capillary rise, and, also, that the molecular coefficient of drop weight is a true constant. The drop-weight method is therefore the most accurate available for the determination of molecular weights, except that for permanent gases, which is based on the density. It is also shown that critical temperatures can be more readily and accurately calculated from drop weights than from capillary rise. E. G.

New Formulæ Correlating the Various Constants for Non-associated Liquids. ERIC HIGGINS (*J. Amer. Chem. Soc.*, 1908, 30, 1069—1074).—Morgan and Stevenson (this vol., ii, 356) and Morgan and Higgins (preceding abstract) have described a method of determining the volumes (and hence the weights) of drops of non-associated liquids delivered from the specially cut end of a capillary tube.

Since the drop volume is proportional to the surface tension, it is shown that $vM/T = K$, where M is the molecular weight of the substance in the liquid state, v the drop volume, and T the absolute temperature of the b. p. By means of these drop-volume constants of certain non-associated liquids (benzene, pyridine, chlorobenzene, aniline, and quinoline), the following can be calculated from a knowledge of the b. p., molecular weight, and density: the surface tension, critical temperature and pressure, vapour pressure at any temperature, latent heat of evaporation, and the value of a and b in van der Waals' equation. It is also shown that the drop weight and b. p. of a liquid enable its molecular weight to be ascertained, and hence all the constants already enumerated can be calculated. E. G.

Viscosity of Non-aqueous Solutions of Potassium Iodide. FREDERICK H. GETMAN (*J. Amer. Chem. Soc.*, 1908, 30, 1077—1084).—In earlier papers (Abstr., 1907, ii, 744; this vol., ii, 464), it has been suggested that the cations of an electrolyte lower the viscosity of a solvent, whilst the anions and non-ionised molecules increase it. It has been considered desirable to test this hypothesis by working with non-aqueous solutions in which the degree of ionisation is less than in water. For this purpose, a study has been made of solutions of potassium iodide in methyl and ethyl alcohols, ethylene glycol, glycerol, furfuraldehyde, acetone, and pyridine. The density of the solutions at 25°/4°, the absolute viscosity, and the ratio of the absolute viscosity of the solutions to that of the solvents are recorded.

The results show that all the solutions, except that in glycerol, exhibit positive viscosity. The negative viscosity of the glycerol solution is attributed to the association of the solvent. The value of the ratio of absolute viscosity to molecular volume has been calculated for fifty non-associated organic liquids, and found to be approximately constant for members of the same class of compounds in the same series. From this ratio, it is inferred that the degree of association of glycerol exceeds that of water. The conclusion that the cation of the electrolyte and the association of the solvent determine negative viscosity is confirmed. E. G.

Critical Opalescence. Victor Rothmund (*Zeitsch. physikal. Chem.*, 1908, **63**, 54—82. Compare Abstr., 1898, ii, 503; also Friedländer, Abstr., 1901, ii, 643).—Mixtures of *n*-butyric acid and water, for a short interval above the critical solution temperature, exhibit a peculiar bluish opalescence or turbidity. This opalescence is very markedly diminished by dextrose, as well as by a number of salts, but is increased by naphthalene.

The temperature-coefficients of viscosity of these ternary mixtures about the critical solution temperature have been determined, and it is found that in this respect there is no essential difference between dextrose and the salts, on the one hand, and naphthalene, on the other. The influence of these substances on the critical opalescence must therefore be optical in its nature.

According to Donnan (*Chem. News*, 1904, **90**, 139), the interfacial tension at temperatures slightly above the critical solution temperature is still positive for very small radii of curvature, but negative for all ordinary curvatures. If this is so, then the critical opalescence is due to the presence of very fine drops, and a mixture may be really non-homogeneous above the critical solution temperature. The author accepts this explanation, and suggests that the influence of a third substance in diminishing or increasing the opalescence observed in mixtures of *n*-butyric acid and water is due to an alteration of the refractive index of one of the phases. The nearer the refractive indices of the two phases the more difficult will it be to detect the opalescence, and any substance which brings the index of the one phase nearer to that of the other will apparently diminish the opalescence. J. C. P.

Cause of the Decoloration of Coloured Liquids by means of Various Charcoals. Fritz Glassner and Wilhelm Suida (*Annalen*, 1908, **361**, 353—362).—It was shown previously (Abstr., 1907, ii,

932) that lampblack, although free from nitrogen and ash, decolorises certain, especially basic, dyes. As this is not in agreement with the behaviour of charcoals in general, the authors have further studied the decolorising action of two specimens of lampblack and one of acetylene-black, all of which were free from nitrogen and ash, and were in a state of fine division.

When boiled with water, lampblack has an odour of camphor; the evaporation residue, as also that from the alcoholic extract, does not absorb dyes. The benzene extract, on the other hand, contains an oil, which has a terpene- or camphor-like odour, and is partly volatile with steam; the evaporation residue absorbs basic dyes from aqueous solutions. The lampblacks differ from animal charcoals in that absorbed dyes are readily dissolved by dilute acids, alkalis, or alcohol, although not by water. As it was observed that the amount of dye absorbed by a lampblack varies with its percentage of oxygen, experiments were performed with a large number of phenols, carboxylic acids, and sulphonic acids, and it was found that these have mostly a high absorptive power for basic dyes. Moreover, it is found that aurine, rosolic acid, and hæmatoxylin form insoluble compounds with acid dyes. It is suggested that, whilst the absorptive power of animal charcoals results from the presence of substances containing the group N·C·N, that of the lampblacks depends on the presence of oxygen compounds, which form phenolic salts with basic, and oxonium salts with acid, dyes. The authors reply to criticisms by Rosenthaler (this vol., ii, 158). G. Y.

Diffusion of Albumin into Gelatin Jellies. G. Möllhausen (*Zeitsch. Chem. Ind. Kolloide*, 1908, 2, 325).—When dry egg- or blood-albumin is placed on the top of a column of solidified gelatin solution containing 2—10% gelatin, the albumin forces its way into the jelly. After some days, a crack appears in the jelly, and this gradually increases in length. Rise of temperature favours the phenomenon. The albumin abstracts large quantities of water from the jelly during the diffusion process.

Addition of phenol to the albumin or jelly has no influence on the phenomenon. It also takes place when the albumin is dissolved previously in an equal weight of water, and when the jelly contains 10% of albumin. Diffusion of the mineral constituents and of the yellow colouring matter of the albumin into the jelly precedes the formation of the crack. The phenomenon cannot be ascribed to a tanning action. H. M. D.

Osmotic Pressure of Compressible Solutions of any Degree of Concentration. Part II. Cases in which both Solvent and Solute are Volatile. Alfred W. Porter (*Proc. Roy. Soc.*, 1908, 80, *A*, 457—465. Compare Abstr., 1907, ii, 743).—The theory previously developed connecting osmotic pressure with vapour pressure in compressible solutions under any hydrostatic pressure is extended to the general case where the solute, as well as the solvent, has an appreciable vapour pressure. By means of a thermodynamic cycle, it is shown that the variation of vapour pressure of the solvent, and also of the osmotic pressure, with variation of the hydrostatic pressure is expressed by the same equations as in the case where the solute is non-volatile. A simple proof is given that the vapour pressure of a pure liquid increases with hydrostatic pressure, by assuming that membranes can exist permeable to vapour, but not to liquid molecules. This proof cannot be extended to solutions, because a space variation of concentration would be set up by gravity under the conditions of the proof. The increased vapour pressure at a curved surface (Kelvin's formula), and also at an electrified surface, is supposed to originate in the higher hydrostatic pressure. R. J. C.

Osmotic Pressure of Sucrose Solutions at 10°. HARMON N. MORSE and H. V. MORSE (*Amer. Chem. J.*, 1908, **39**, 667—680).—In view of the fact that the osmotic pressures of sucrose and dextrose solutions at 0° are somewhat in excess of the calculated gas pressures, whereas at 20° the two pressures are in agreement, it was considered desirable to determine the pressures of such solutions at several intermediate temperatures. The results of measurements of the osmotic pressure of sucrose solutions at 5° have already been recorded (Abstr., 1907, ii, 744), and in the present paper an account is given of determinations made at 10°.

It is found that the osmotic pressure of sucrose solutions at 10°, like those at 0° and 5°, considerably exceeds the calculated gas pressure; it diminishes slightly from the $0{\cdot}1N$ to the $0{\cdot}4N$ solution, and then increases with increasing concentration. On comparing the pressures at 0° and 10°, some indications of a temperature-coefficient are observable, and this fact will be alluded to again when the results obtained at 15° are recorded. E. G.

Vapour Pressure and Osmotic Pressure of Strong Solutions. HUGH L. CALLENDAR (*Proc. Roy. Soc.*, 1908, **80**, *A*, 466—500).—A theory of solutions is developed on the basis of a simple hypothesis connecting vapour pressure and concentration.

Arguments are first adduced to show how osmotic and other properties of solutions may be explained quantitatively as the result of differences in vapour pressure. An equation is obtained connecting vapour pressure with hydrostatic pressure, according to which a hydrostatic pressure of 2000 atmospheres is necessary to increase the vapour pressure of water four-fold at 27° if its compressibility remains constant.

Consideration of the hypothetical vapour sieve apparatus of Poynting (*Phil. Mag.*, 1881, [v], **12**, 40) leads to the result that if a solution and the pure solvent, each contained in a vapour sieve tube, are in equilibrium with the same vapour column, they are in equilibrium with one another. The solution is necessarily under greater hydrostatic pressure than the pure solvent in this case. No disturbance will ensue if the solution sieve be actually surrounded by the solvent column, that is to say, the liquids are in osmotic equilibrium also.

A semi-permeable membrane may therefore be considered as a vapour sieve, and osmotic pressure may be defined as the hydrostatic pressure which must be applied to increase the vapour pressure of a solution to that of the pure solvent. Conversely, liquids in osmotic equilibrium necessarily have the same vapour pressure.

The osmotic pressure of a solution is independent of hydrostatic pressure only if the solvent occupies the same volume in the solution as in the pure state. In a column of solution, the increase in vapour pressure downwards will be the difference between the increase due to hydrostatic pressure and the decrease due to the concentration of the solute by gravity, so that the gravity effect can be evaluated in the case of sucrose solutions from Berkeley and Hartley's vapour pressure measurements.

All the foregoing relationships can be simply established by equating to zero the work done in taking unit mass of solvent round a closed "osmotic circuit," and the author prefers this method to the isothermal cycle method employed by Porter (Abstr., 1907, ii, 743). An equation is obtained connecting hydrostatic pressure with latent heat of vaporisation, from which it appears that a pressure of 42 atmospheres would increase the latent heat of water by 1 cal.

The author's theory of solutions is based upon the hypothesis that the vapour pressure of a solution should be proportional to the ratio of the number of molecules of free solvent to the total number of molecules in the solution, molecular aggregates and hydrates being considered as single molecules. Thus if in a solution of n molecules of solute in N molecules of solvent each molecule of solute appropriates a molecules of solvent, the number of free molecules of solvent will be $(N-an)$, and the total number of molecules will be $(N-an+n)$. If p' and p'' be the vapour pressure of solvent and solution, $p''/p' = (N-an)/(N-an+n)$. If sucrose be considered to hold 5 molecules of water of hydration, and if dextrose holds 2 molecules, this equation gives results which agree with Berkeley and Hartley's determinations of the osmotic pressure of these two substances within the limits of experimental error. The calculation must be made on a weight normal basis, and the hydration considered to be constant over the whole range of dilutions.

It is pointed out that the latent heat of fusion of ice has not the same value at temperatures below the freezing point as at 0°, and that the "molecular lowering" of the freezing point of water by a dissolved substance, which depends on the latent heat of fusion of the solvent, must also vary with the temperature; furthermore, the freezing-point lowering is generally tacitly assumed to be directly proportional to the ratio of the difference of vapour pressures of ice and water to the vapour pressure of water. Therefore the author considers that the usual method of comparing the found with the calculated freezing-point depressions is futile in the case of strong solutions with a freezing point far removed from 0°.

Owing to the uncertainty of existing data for the vapour pressure of water below 0°, an exact formula connecting the vapour pressures of water and ice is not possible. A number of possible formulæ are obtained by considering an "osmotic circuit," and the author finally adopts as the best approximation the simple expression $\log_e(p'/p) = -2{\cdot}64t/273$, where p' and p are the vapour pressures of water and ice respectively, at t° Centigrade. On this basis, the freezing-point depressions of sucrose solutions agree very well with the calculated values when the hydration (a) is taken as 5. The depressions of methyl- and ethyl-alcohol solutions containing upwards of 20 mols. per 100 of solvent agree very well with the theòretical when the hydration is taken as 1. Glycerol appears to have hydration 2, but the freezing-point diagrams of acetone and formic acid lie very near the curve plotted with $a = -1$, which suggests that the molecules of these substances associate with each other.

The application of the theory to electrolytes is complicated by questions of electrolytic dissociation. Assuming the number of free ions to be proportional to the conductivity, the following hydrate values are deduced from freezing-point data: $HCl,5H_2O$; $CaCl_2,9H_2O$; $MgCl_2,12H_2O$; KCl,H_2O; $NaCl,2H_2O$.

When the rise of the boiling point of solutions is considered from the author's point of view, sucrose appears to have the same hydration at 100° as at 0° (namely, $5H_2O$), except in the strongest solutions, where it is somewhat less. Potassium and sodium chlorides, on the other hand, are calculated to be more highly hydrated at 100° ($KCl,4H_2O$; $NaCl,6H_2O$) than at the freezing point.

On thermodynamic principles, the hydration of a substance cannot remain constant on diluting its solutions unless the heat of dilution is zero, as in the case of sucrose. Consideration of the special case of hydrochloric acid with its great heat of dilution indicates that the variation in hydration is not necessarily very great, particularly as the heat developed on dilution may be partly the result of increased dissociation.

The author claims to have made out a good *prima facie* case for a modified form of the hydrate theory of solutions, and compares his results with those obtained by other advocates of the same hypothesis. R. J. C.

The Solubility Product. JULIUS STIEGLITZ (*J. Amer. Chem. Soc.*, 1908, **30**, 946—954).—This paper contains a discussion of the principle of the solubility product which was enunciated by Nernst (Abstr., 1890, 3). From the data obtained by Arrhenius (Abstr., 1900, ii, 201) on the solubilities of silver acetate, propionate, butyrate, valerate, and chloroacetate in the presence of an excess of the corresponding sodium salt, the values of the solubility product ($C_{Ag} \times C_{acid\ ion}$) have been calculated. The results of Nernst's determinations (*loc. cit.*) of the solubility of silver acetate in presence of sodium acetate and silver nitrate respectively have also been re-calculated.

The results show that the solubility product has no theoretical foundation, and is only to be regarded as an approximate empirical principle. In the case of the organic silver salts, the principle is sufficiently in agreement with the observed facts to prove of some practical value, and this conclusion confirms the results obtained by other authors on the solubility of a salt in presence of other electrolytes having a common ion. E. G.

Relationships between Chemical Composition, Crystalline Form, Hardness, and Density. I. VIKTOR PÖSCHL (*Zeitsch. anorg. Chem.*, 1908, **59**, 102—107).—The author has found certain relationships between the crystalline form, hardness, and density of polymorphic minerals. Of two such polymorphic forms, that which has the greater density and the greater crystalline symmetry is never less hard than the second modification. If the modification of a lower degree of symmetry has the greater density, this form is never less hard than the second form.

The densities of a number of mineral sulphides have been compared with those of the constituent elements. In all cases, the density of the mineral is intermediate between the densities of the elements. The former can be approximately calculated from the latter by means of the simple mixture rule. The calculated densities are, in nearly all cases, somewhat smaller than the experimental values. The deviation between the two values is shown to be a periodic function of the atomic weight of the metal. H. M. D.

Relation between the Crystalline Form and Chemical Constitution of the Picryl Derivatives. George Jerusalem and William J. Pope (*Proc. Roy. Soc.*, 1908, **80**, *A*, 557—566).—The theory of Barlow and Pope as to the relation between crystalline form and chemical constitution (Trans., 1906, **89**, 1675; 1907, **91**, 1150) has been further tested by application to a number of derivatives containing the 1 : 3 : 5-trinitrophenyl or picryl group.

As regards crystalline structure, benzene and its simple derivatives belong to one of two types: one, derived from the closest-packed assemblage of equal spheres of hexagonal type, has the equivalence parameters $x : y : z = 3{\cdot}101 : 3{\cdot}480 : 2{\cdot}780$; the other is derived from the closest-packed assemblages of equal spheres of cubic type. The direction of z is perpendicular to the two planes containing the centres of the two sets of hydrogen atoms ordinarily numbered 1 : 3 : 5 and 2 : 4 : 6 respectively. Of the thirteen picryl compounds for which data are now available, it is shown that nine belong to the hexagonal type, and that for these compounds the effect of substitution is to alter two of the dimensions only, the third, of relative length 2·780, corresponding with the z dimension of benzene, remaining practically unaltered.

Among the substances belonging to the rhombohedral arrangement are *s*-trinitrobenzene and picric acid. On passing from *s*-trinitrobenzene to the similarly-constituted tribromodinitrotoluene there is practically no change in the equivalence parameters, corresponding with the fact that the valencies of the groups displaced are the same as those of the original groups. G. S.

Dimorphism of Potassium Calcium Chromate. A. V. Rakowski (*Bull. Acad. Sci. St. Petersburg*, 1908, **10**, 905—917).—The object of the research was to test the question whether two polymorphic forms of a substance can belong to the same crystalline system.

The β- and α-forms of potassium calcium chromate,

$$K_2Ca(CrO_4)_2,2H_2O,$$

the crystalline characters of which are discussed in detail, are prepared by the action of unslaked lime on potassium dichromate, the quantity of each modification formed depending on the pressure and temperature at which crystallisation occurs, and on the presence of other substances in the solution.

The α-modification belongs to the rhombic system [$a : b : c = 2{\cdot}3629 : 1 : 2{\cdot}0946$], D^{15}_{15} 2·449 (2·413 for large crystals), molecular heat of solution 6993 Cal. The β-modification belongs to the hemihedral triclinic system [$a : b : c = 0{\cdot}7591 : 1 : 0{\cdot}8915$; $\alpha = 86°10'$; $\beta = 94°4'$; $\gamma = 81°40'$], D^{15}_{15} 2·611 (2·600 for large crystals), molecular heat of solution 5458·8. Solubility curves and tables are given for both varieties, showing that the solubility of each increases with the temperature, and that the α-modification is unstable with reference to the β-form, the transition-temperature of the former being at about 0°.

At 97° the dry salt decomposes, thus: $K_2Ca(CrO_4)_2,2H_2O \rightleftharpoons K_2CrO_4 + CaCrO_4 + 2H_2O$. A solution satuated at 20° becomes cloudy at 55—60°, and the precipitate formed at 90—100° corresponds with the formula $K_2CrO_4,4CaCrO_4,2\frac{1}{2}H_2O$; at 260°, the water in this salt commences to separate. Z. K.

Liquid Crystals. Th. Rotarski (*Ber.*, 1908, **41**, 1994—1998). **Clear Transparent Crystalline Liquids.** Daniel Vorländer (*ibid.*, 2033—2052).—See this vol., i, 640, 641.

Theory of Colloids. Eduard Jordis (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 361—367).—A critical examination of the principles underlying a theory of colloids. In this first portion of the paper, the various possible types of homogeneous mixtures which may be classified under the head of solutions are discussed. A hydrosol regarded as a homogeneous mixture of solid and liquid particles is considered to satisfy the requirements of the definition of a solution.
H. M. D.

Diagrammatic Representation of Equilibria between Acids and Bases in Solution. Lawrence J. Henderson (*J. Amer. Chem. Soc.*, 1908, **30**, 954—960).—Diagrams have been constructed which express the requirements of the concentration law regarding the equilibrium in solution between strong acids and bases, and between strong bases and acids, of all strengths, but are not suitable for solutions of high acidity or alkalinity. These diagrams accurately define the conditions of equilibrium at all concentrations of hydrogen and hydroxyl ions, between all acids and bases, with the exceptions already mentioned, and in all mixtures of such substances. They also define all isohydric solutions of such substances in which this quality depends only on the equality of the concentration of hydrogen and hydroxyl ions. E. G.

Calcium Phosphates. III. The System $CaO{-}P_2O_5{-}H_2O$. Henry Bassett, jun. (*Zeitsch. anorg. Chem.*, 1908, **59**, 1—55. Compare Proc., 1906, 315).—By means of dilatometer experiments, the position of quintuple points on the space model of the three-component system $CaO{-}P_2O_5{-}H_2O$ has been determined. At these temperatures changes take place which, on the basis of solubility measurements, can be formulated by the following equations:

36°. $CaHPO_4,2H_2O = 0{\cdot}9985\ CaHPO_4 + 0{\cdot}000384\ Ca_3(PO_4)_2,H_2O + (2{\cdot}00036\ H_2O + 0{\cdot}00033\ CaO + 0{\cdot}00036\ P_2O)_5$.

21°. $CaHPO_4,2H_2O + 0{\cdot}138\ CaH_4(PO_4)_2,H_2O = 1{\cdot}0747\ CaHPO_4 + (2{\cdot}374\ H_2O + 0{\cdot}10007\ P_2O_5 + 0{\cdot}0627\ CaO)$.

152°. $CaH_4(PO_4)_2,H_2O = 0{\cdot}495\ CaH_4(PO_4)_2 + 0{\cdot}427\ CaHPO_4 + (1{\cdot}80\ H_2O + 0{\cdot}292\ P_2O_5 + 0{\cdot}078\ CaO)$.

The formulæ in brackets represent the composition of the solutions in equilibrium with the solid phases at the various quintuple points.

As the result of measurements of solubility at 25°, 40°, and 50·7°, isothermals have been obtained, on the basis of which the space model for the three-component system has been constructed.

The observation of van't Hoff, that the velocity with which changes in complicated systems take place diminishes with increasing basicity of the acid radicle and increasing valency of the metal, is confirmed by the author's observations.

The paper concludes with certain speculations as to the nature of the calcium phosphates which have been examined, and as to the condition of the phosphoric acid contained in soils. H. M. D.

The Ternary System: Mercuric Chloride, Ammonium Chloride, and Water at 30°. P. A. Meerburg (*Zeitsch. anorg. Chem.*, 1908, 59, 136—142; *Chem. Weekblad*, 1908, 5, 429—435).—The three-component system has been examined according to the methods of the phase rule. Data are recorded representing the composition of the aqueous solutions in equilibrium with the various combinations of solid phases. Of the various double salts described in the literature, namely, $HgCl_2,NH_4Cl$; $HgCl_2,NH_4Cl,H_2O$;

$HgCl_2,2NH_4Cl,H_2O$;

$9HgCl_2,2NH_4Cl$, and $3HgCl_2,2NH_4Cl,4H_2O$, the first and last do not exist at 30° according to the author's experiments. These, however, indicate the existence of a double salt of the composition

$3HgCl_2,2NH_4Cl,H_2O$.

Of the various double chlorides, $HgCl_2,2NH_4Cl,H_2O$ is the only one which can be recrystallised from its aqueous solution. H. M. D.

Calculation of Hydrocarbon Equilibria. H. von Wartenberg (*Zeitsch. physikal. Chem.*, 1908, 63, 269—272).—An error having crept into the calculation of the methane equilibrium in the earlier paper (this vol., ii, 26), this calculation is revised, with the result that the deviation between observed and calculated figures is greater than before. No complete explanation of the discrepancy can be expected until the equilibrium has been subjected to further experimental investigation. J. C. P.

Statics and Kinetics of the Transition which occurs in Liquid Sulphur. Heat of Fusion of Monoclinic Sulphur. Albert Wigand (*Zeitsch. physikal. Chem.*, 1908, 63, 273—306).—The heat of fusion of monoclinic sulphur has been determined by an electrical method. A weighed quantity of sulphur was put in a glass vessel inside an oil calorimeter, which in its turn was surrounded by an electric bath kept at 116°. When it was certain that the sulphur had been completely converted into the monoclinic variety, a known amount of energy was added by passing a current through a wire embedded in the sulphur; the added heat was so adjusted as to melt all the sulphur and to raise the temperature of the calorimeter about 5°, more or less. The value so found for the heat of fusion is 10·4 cal. for 1 gram of sulphur, with a possible error of ± 3%.

From this figure, the molecular depression constant for monoclinic sulphur is calculated by van't Hoff's formula; if further 42·5° is taken as the depression due to a gram atom of the insoluble variety (see Smith, Abstr., 1903, ii, 139) the number of atoms in a molecule of this insoluble sulphur works out to 6·9. The author, however, considers that 8 is more probably the correct number (see Smith, *loc. cit.*), and S_8 is accordingly taken as representing the molecular condition of both the soluble and the insoluble modifications.

The view that the two molecules have the same number of atoms, and that liquid sulphur is subject to a reversible isomeric change, $S_{8\ \mathrm{sol.}} \rightleftharpoons S_{8\ \mathrm{insol.}}$, is supported by Schaum's figures, which show how the freezing point of a sample of sulphur falls when it is kept for gradually increasing periods at temperatures above 120°. From these figures, it is possible to calculate satisfactory velocity-coefficients for the foregoing isomeric change, and from the values of the coefficient at different temperatures it is calculated that the heat absorbed when 1 gram of liquid soluble sulphur is transformed into the liquid insoluble modification is 21·1 cal.

From all this, it appears that the transition which occurs in liquid sulphur is an intramolecular rearrangement, which does not involve any change in the molecular weight (compare Smith, *loc. cit.*). J. C. P.

Affinity Constants of Organic Acids determined with the Help of Indicators. EDUARD SALM (*Zeitsch. physikal. Chem.*, 1908, 63, 83—108).—The affinity constants of sixty-eight organic acids have been determined by the indicator method already described (Friedenthal, Abstr., 1904, ii, 288; Salm, Abstr., 1904, ii, 536; 1906, ii, 218. Compare also Veley, Trans., 1907, 153, 1246). Solutions of hydrochloric acid were used as standards of comparison, and the indicators employed were dimethylaminoazobenzene, methyl-orange, and tropæolin-00. In the great majority of cases, the affinity constants deduced in this way are in good agreement with the values reached by the conductivity method. In the case of formic and oxalic acids, the value of the expression $a^2/(1-a)V$ falls off on dilution. J. C. P.

Saponification of Glycerides during Ester Exchanges in Homogeneous System. MILAN J. STRITAR and RICHARD FANTO (*J. pr. Chem.*, 1908, [ii], 78, 35—41. Compare Abstr., 1904, i, 843; 1907, i, 277).—The authors have calculated the results of their experiments on the saponification of rape-seed oil, as suggested by Wegscheider (this vol., ii, 165). If it is assumed that at the moment when the saponification is stopped the product is a mixture of diglyceride and ester, the mean partition coefficient for the second minute of the experiment is found to be 1·88, whilst that for the third minute is 1·02, hence in the second minute about twice as much glyceride as ester is saponified, whereas in the third minute the amounts are approximately equal. If, on the other hand, it is assumed that, at the moment of stoppage of the saponification, the combined glycerol is present as a mixture of tri- and mono-glycerides, the partition coefficient for the second minute is 2·35, and for the third minute, 1·28. Here, again, the saponification of the glyceride decreases in comparison with that of the ester. These results are in agreement with the authors' views as to the mechanism of the saponification of fats.

The remainder of the paper is a reply to Kremann (this vol., i, 120).

G. Y.

Schütz's Rule for Reaction Velocities. Svante Arrhenius (*Meddel. K. Vetensk. Nobelinst.*, 1908, **1**, No. 9, 1—17).—The author discusses a relationship pointed out by Schütz (Abstr., 1885, 1147) in connexion with the rate of action of pepsin on albumin. According to this, the quantity of albumin transformed in a given time by different amounts of pepsin is proportional to the square root of the pepsin concentration, provided that the reaction is not allowed to proceed too long. The same relationship has since been found in the action of trypsin and of lipolytic ferments.

It is shown that for the validity of Schütz's rule, the reaction velocity must be inversely proportional to the quantity of substance already transformed. This condition is fulfilled when one of the reacting substances is influenced by one of the products of reaction in such a way that the active mass of the former is inversely proportional to the active mass of the latter.

An example of such a reaction is afforded by the saponification of an ester present in large excess by a weak base, like ammonia. The reacting component to be considered is the OH' ion, and the active mass of this is determined by the dissociation equation

$$k[NH_4OH] = [NH_4^{\cdot}][OH'].$$

As saponification proceeds, the concentration of the $NH_4^{\cdot}$ ions increases proportionally with the amount of ester saponified, and corresponding with the dissociation equation the concentration of the OH' ions diminishes in inverse proportion.

Measurement of the rate of saponification of ethyl acetate by ammonia, under the conditions specified, has shown that Schütz's rule is valid until about half the ammonia has been transformed. From this point, the deviations between experiment and the requirements of the rule increase very rapidly. The progress of the reaction was followed by determination of the electrical conductivity of the solution.

An action similar to that of an ammonium salt on ammonia is supposed to determine the similar progress of the action of pepsin on albumin. The cause of the action is supposed to be the combination of the reaction product with the ferment.

H. M. D.

Review of the Various Theories of Passivity. Fresh Observations on the Passivity of Iron, Nickel, and Chromium. Carl Fredenhagen (*Zeitsch. physikal. Chem.*, 1908, 63, 1—47. Compare Abstr., 1903, ii, 353; 1906, ii, 76; also Finkelstein, Abstr., 1902, ii, 81; Müller, Abstr., 1904, ii, 610).—The passivity of metals is supposed by some to be due to the formation of a film of oxide on the surface of the metal, and by others to be due to the change of the metal into another modification. The author rejects both these explanations, and argues in favour of the view, previously upheld by him (*loc. cit.*), that in the passive condition the metal is protected by a surface layer of gas.

The experiments recorded in the paper consisted in applying a gradually increasing or a gradually diminishing *E.M.F.* to an iron, nickel, or chromium electrode immersed in sulphuric acid, and determining (1) the *P.D.* at this electrode, and (2) the strength of the polarisation current. The *P.D.* of the metal electrode at the point where passivity or activity sets in is not well defined, and this supports the view that the passivity phenomena do not depend on the formation either of an oxide film or of another modification of the metal, but that they are ultimately related to the rate at which the metal becomes charged with oxygen. Further, the *P.D.* recorded when passivity or activity sets in is markedly affected by slight changes in the strength of the sulphuric acid, and rise of temperature has a notable influence in favouring the active condition. At an iron electrode immersed in sulphuric acid and subjected to anodic polarisation, some reactions take place which lead to the production of oxygen, and others use up oxygen. According to the author, the passive condition is reached when the oxygen polarisation extends uniformly over the whole surface of the electrode, and the reappearance of the active state on lowering the polarisation *E.M.F.* is due to the fact that the reactions which use up oxygen begin to overbalance those which produce oxygen. J. C. P.

The Excitation and Regulation of Catalytic Pulsations by means of an Electric Current. Georg Bredig and Ernst Wilke (*Biochem. Zeitsch.*, 1908, 11, 67—81).—Bredig and Weinmayer have shown that the catalytic decomposition of hydrogen peroxide into water and oxygen, a reaction discovered by Thénard, takes place under certain conditions in rhythmical periods. The influence of electrical currents on this rhythm has been studied. The peroxide solution was placed in a vessel, with mercury at the bottom, into which an electrode passed. The other electrode was placed in the peroxide solution. The apparatus was so arranged that the evolution of oxygen could be graphically recorded. It was found that by means of a constant current, alternating current, or induction shock, an a-periodic chemical change could be converted into a period change. Also, that a spontaneous rhythmical catalysis could be modified as regards its pulsation form, its period, or intensity by means either of a constant or alternating current. The relations of these phenomena to certain biological processes, such as nerve stimulation, are discussed. S. B. S.

Catalysis in Heterogeneous Systems. Decomposition of Chromous Chloride by means of Platinum. CASIMIR JABCZYŃSKI (*Bull. Acad. Sci. Cracow*, 1908, 398—401).—The decomposition of chromous chloride between platinised platinum plates has been examined. Between 25° and 55° the reaction appears to be unimolecular. When smooth platinum foil is used, the velocity is some three times smaller than with platinised plates. The velocity of decomposition varies with the rate at which the liquid is stirred. The temperature-coefficient, 2·75% per 1°, is the same as for ordinary diffusion experiments, so that the velocity appears to depend entirely on diffusion, and the actual chemical reaction proceeds with enormous velocity. The effect of non-electrolytes, for example, alcohol and sugar, on the velocity is exactly the same as for other diffusion experiments.

The velocity depends on the amount of hydrochloric acid present, and is accelerated by the addition of potassium or calcium chloride, but diminished by the addition of chromic chloride. The reaction does not proceed in the presence of potassium chloride unless free acid is also present.

These phenomena are accounted for by the assumption of the formation of an additive compound of chromous and chromic chlorides, which has a slower rate of diffusion. Addition of hydrochloric acid, potassium chloride, or calcium chloride tends to decompose this compound, liberating chromous chloride, whereas increase in the concentration of the chromous chloride, or addition of chromic chloride, increases the amount of the additive compound.

Iodine and mercuric chloride do not affect the decomposition, whereas small amounts of hydrogen sulphide diminish the rate of decomposition; hydrocyanic acid acts less readily. J. J. S.

Catalysis. VI. Catalysis of Imino-esters. HERMANN I. SCHLESINGER (*Amer. Chem. J.*, 1908, **39**, 719—771. Compare Stieglitz, this vol., ii, 167, 168; Derby, this vol., i, 419).—Measurements have been made of the velocity of hydrolysis of the hydrochlorides of methyl and ethyl iminobenzoates in 1/10 and 1/40 molar solutions, and also of the velocity of decomposition of methyl, ethyl, and *n*- and *iso*-propyl iminobenzoates, and of methyl *m*-nitroiminobenzoate, under the influence of varying proportions of barium hydroxide. A study has also been made of the decomposition of methyl iminobenzoate in aqueous solutions. The results are tabulated, and lead to the conclusions which have already been expressed by Stieglitz (*loc. cit.*). E. G.

Potential Energy of the Elements. DANIEL J. RANKIN (*Chem. News*, 1908, **97**, 302—303).—An element is regarded as a system of energy which under normal conditions exist in two states, static or intrinsic energy and potential energy. The intrinsic energy is incapable of being freed, is inert, and is uninfluenced by any ordinary extraneous energy whatsoever. The potential or free existing energy permits of calculation in terms of thermal calories, and this the author has done for seventy-seven elements. In thermochemical measurements, the "heat of formation" is the value of that portion of the potential which is lost or integrated, and the resulting compound undergoes diminution or increase in volume in a fixed ratio to the loss or gain of potential. For most elements the atomic weights of which are below 60, it has been found that the ratio of loss of potential to loss of volume = 1 : 1, except in the zinc, cadmium, mercury family, where it is 1 : 0·76, and with sodium, calcium, and potassium, 1 : 0·65 nearly. Examples are given showing that it thus becomes possible to calculate the density of a substance, such as solid oxygen or chlorine, when existing in a chemical compound; also, the specific gravity of a chemical compound when the heat of formation is given.

J. V. E.

Deduction of Stoicheiometric Laws. F. WALD (*Zeitsch. physikal. Chem.*, 1908, 63, 307—324).—In replying to de Vries (this vol., ii, 366), the author maintains and extends his earlier views as to the possibility of deducing all quantitative chemical relationships from purely qualitative data. The limitations of the atomic hypothesis and of the theory of valency are emphasised. The author shows that of all the facts to which the name "stoicheiometric" can be applied, the most general is this, that a qualitative analysis is possible without a quantitative.

J. C. P.

Safety Apparatus for Ovens, Baths, &c. LOUIS L. DE KONINCK (*Bull. Soc. chim. Belg.*, 1908, 22, 192—195).—A modified form of H. Michaelis' apparatus (Abstr., 1897, ii, 169) devised to automatically cut off the supply of gas to burners placed under baths, &c., provided with constant supply arrangements for water, in case the water supply is temporarily stopped, is described and figured.

T. A. H.

Simple Arrangement for Continuous Extraction with a Solvent of Inconstant Boiling Point. EMIL WÖRNER (*Chem. Zeit.*, 1908, 32. 608).—When using a Zuntz pattern Soxhlet apparatus for extracting with a solvent of no very definite boiling point, such as light petroleum, a mixture of alcohol and chloroform, &c., it is recommended that a wire spiral be placed round the extraction cup instead of the fragile glass tube. In this manner, the solvent of slightly lower boiling point is prevented from accumulating in the upper region of the tube, and by having intermediate porous layers of sand or wadding the extraction takes place quite rapidly.

J. V. E.

Circulation Stirrer for Liquids. ROBERT GOETZE (*Chem. Zentr.*, 1908, i, 1509—1510; from *Zeitsch. Chem. Apparatenkunde*, 1908, 3, 147).—A tubular glass stirrer having four short, horizontal open limbs is made to revolve rapidly in a flask-shaped vessel containing the liquid, so that the liquid is forced by the revolving limbs up a side-tube situated exactly opposite them, the action being similar to that of a centrifugal pump. The return liquid enters the vessel through the hollow spindle of the stirrer.

J. V. E.

Inorganic Chemistry.

Decomposition of Water Vapour by Electric Sparks. Alfred Holt, jun., and Edwin Hopkinson (*Phil. Mag.*, 1908, [vi], 16, 92—110).—The authors have examined the decomposition of water vapour and carbon dioxide by electric sparks, and the conclusion is drawn that the separation and distribution of the decomposition products noted by previous observers in the case of water vapour is not an electrical phenomenon, but is the result of gaseous diffusion. The decomposition effects cannot be explained by ordinary electrolysis.

When sparks are passed through water vapour contained in an apparatus of the type used by Chapman and Lidbury (Trans., 1902, 81, 1301), hydrogen and oxygen are produced in the path of the spark. On account of its greater rate of diffusion, the hydrogen tends to become uniformly distributed throughout the apparatus, even when a rapid current of vapour is passing through it. The distribution of the oxygen depends on the relative position of the tube, through which the water vapour enters the sparking vessel, in reference to the anode and cathode. When the water vapour enters at the anode, the greater portion of the oxygen will be swept out at the cathode and vice versa. With the entrance tube near the centre of the spark-gap, equal quantities of oxygen are swept towards the separate poles. This view is supported by experimental data, and it is shown that, under like conditions, the products of decomposition of carbon dioxide, corresponding with their nearly equal rates of diffusion, are always distributed symmetrically.

The observation made by Chapman and Lidbury (*loc. cit.*) that the total quantity of water vapour decomposed, and the extent of the separation of the hydrogen and oxygen, is much greater when the current of water vapour enters the discharge tube in the neighbourhood of the cathode instead of near the anode is confirmed. To explain this, it is supposed that the metallic spray produced by the disintegration of the cathode exerts a catalytic action, which results in a greatly increased union of the products of dissociation. With aluminium electrodes, which do not yield such a metallic spray, the effect is not observed. Using platinum electrodes, the effect diminishes when thicker wires are used, corresponding with diminished disintegration; it is also smaller when the bulbs surrounding the electrodes are made larger.

The behaviour of other metallic electrodes has also been examined. Metals which oxidise when heated in air behave like aluminium; those which do not oxidise or which form a volatile oxide, as in the case of osmium, behave like platinum. Silver and palladium are exceptions. Although silver sprays readily, it does not appear to have any effect on the union of the dissociation products. The behaviour of platinum is traced to its exceptionally high catalytic activity.

On this view, J. J. Thomson's observation, that the pole at which the excess of hydrogen or oxygen appeared in his experiments depended on the length of the spark, can also be explained.

H. M. D.

Activity of the Halogens, Chlorine, Bromine, and Iodine in Relation to the Metals in General. M. C. Schuyten (*Chem. Zeit.*, 1908, **32**, 619—620. Compare this vol., ii, 31).—The chlorides of twenty-four metals have been digested with bromine and with iodine, and the bromides of twenty-three metals digested with iodine. After testing the residues from the metallic chlorides and showing the absence of free halogen, they were treated with chlorine water and again tested, when it was generally found that some bromine or iodine was liberated. In the case of the bromides digested with iodine, the dry test for iodine generally indicated the presence of small quantities of that halogen. Whether addition or substitution of halogen takes place under these conditions, the author is at present unable to decide.

J. V. E.

Variation of the Surface Tension of Sulphur with Rise of Temperature: $S\lambda^1$ and $S\lambda^2$. Georges Capelle (*Bull. Soc. chim.*, 1908, [iv], **3**, 764—767).—Smith has shown (Abstr., 1905, ii, 382, 580) that between the melting point (125°) and 160° a definite liquid form of sulphur ($S\lambda$) exists, and that at 160° this passes into a new form ($S\mu$). The author confirms and extends this view from observations on the anomalous change in the surface tension of sulphur as the temperature is raised from 125° to 160°. Between 125° and 142° a slight increase in surface tension takes place, and between 142° and 160° a large and rapid increase. At 160° the liquid becomes viscous, and observations cannot be carried further. It is suggested that Smith's $S\lambda$ is divisible into two species, one ($S\lambda^1$) existing between 125° and 142°, and the other ($S\lambda^2$) between 142° and 160°, but $S\lambda^2$ may be merely a mixture of $S\lambda^1$ with $S\mu$, the formation of the latter commencing at 142° and becoming complete at 160°. T. A. H.

Colloidal Sulphur. M. Raffo (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 358—360).—Soluble colloidal sulphur is obtained when a concentrated solution of sodium thiosulphate is added very slowly to cooled concentrated sulphuric acid (D 1·84). If the addition of the thiosulphate solution is effected too rapidly, a large proportion of insoluble sulphur is formed. The changes taking place are represented by the equations: (1) $H_2S_2O_8 = SO_2 + H_2O + S$ (insoluble); (2) $H_2S_2O_3 = H_2S + SO_3$; $2H_2S + SO_2 = 2H_2O + 3S$ (soluble).

In order to separate the soluble and insoluble sulphur, the thick, cloudy liquid is diluted somewhat, heated to 80°, and filtered through glass-wool. It is then left in a cool place for twelve hours, again heated and filtered, and these operations are repeated until the whole of the insoluble sulphur has been removed. The end product is a cloudy, yellowish-white mass, which, on warming, yields a perfectly clear yellow liquid. On cooling, the colloidal sulphur separates, and is removed by centrifuging, washed with a little cold water, again centrifuged, and dissolved in the least possible quantity of water. The liquid is neutralised by addition of sodium carbonate, which causes the sulphur to separate, and, after centrifuging, a residue of very nearly pure soluble sulphur is obtained.

On removing the sodium sulphate from the neutralised solution by dialysis, it is found that the solution became unstable and insoluble sulphur separates. The conclusion is drawn that a pure aqueous solution of colloidal sulphur cannot be obtained. Separation also takes place on addition of various electrolytes. The sulphur precipitated by sodium chloride or nitrate dissolves on warming or on dilution, and that precipitated by potassium chloride, nitrate, or sulphate is insoluble, Precipitation does not take place, in general, on the addition of ammonium sulphate, nitrate, or chloride, or of sodium sulphate. Dilute unneutralised solutions remain clear for long periods, although small quantities of rhombic and monoclinic sulphur are gradually deposited. Concentrated solutions become cloudy in consequence of the separation of insoluble sulphur. H. M. D.

Spontaneous Oxidation of Sulphur and Sulphides. EGIDIO POLLACCI (*Boll. chim. farm.*, 1908, **47**, 363—368).—Moist sulphur in a state of fine division oxidises in the air to sulphuric acid, the action being accelerated by light. In absence of oxygen, sulphur does not decompose water. Pure oxygen or hydrogen peroxide does not bring about the oxidation, and the active agent present in the air is considered to be ozone.

Metallic sulphides also oxidise in a moist state, the first products being the oxide and sulphur, the latter then oxidising to sulphuric acid. Solutions of hydrogen sulphide do not oxidise directly to sulphuric acid, the first process being the production of water and sulphur, followed by oxidation of the latter. The sulphides of iron, manganese, cobalt, gold, silver, platinum, antimony, and titanium oxidise rapidly, those of calcium, barium, strontium, potassium, arsenic, cadmium, mercury, and tin less rapidly, and those of zinc and copper very slowly. C. H. D.

Preparation of Sulphur Trioxide. RUDOLF FRANK (D.R.-P. 194879).—One of the chief difficulties of the contact process for sulphuric acid is the sensitiveness of the contact material to impurities in the sulphur dioxide, and another is the maintenance of a definite temperature during the operation in order to avoid a reverse chemical change. These difficulties are overcome by compressing sulphur dioxide and oxygen under a pressure of 100 atmospheres, when a complete condensation to sulphur trioxide occurs. By rapidly releasing the pressure, the trioxide may be obtained in a solid condition without appreciable loss of vapour. G. T. M.

Preparation of Sulphuric Acid. OSKAR BENDER (D.R.-P. 195810).—A mixture of oxygen and sulphur dioxide is introduced into a generator furnace in which water-gas is being produced and then burnt. The heat generated induces the combination of these gases to form sulphur trioxide, and the water produced serves to hydrate this substance, forming sulphuric acid. When air is employed, a certain amount of nitric acid is also produced, which exerts its catalytic action on the mixture of gases and increases the formation of sulphuric acid. The furnace is fed with sulphur or sulphur-containing materials. G. T. M.

Quantitative Vaporisation of Phosphoric Acid from Phosphates in a Current of Chlorine and Carbon Tetrachloride or of Carbon Tetrachloride Only. Paul Jannasch and W. Jilke (*J. pr. Chem.*, 1908, [ii], **78**, 21—28. Compare Abstr., 1907, ii, 864).—It is now found that phosphoric acid can be distilled quantitatively from calcium, sodium, or potassium phosphate if the phosphate is thoroughly ground with quartz powder and the mixture heated in a current of chlorine which has been passed through carbon tetrachloride. The calcium phosphate was heated for four hours at a dark red, and for two hours at a bright red, heat in a quartz boat, and the sodium and potassium phosphates for nine hours at a bright red heat in a gas-carbon boat, in a glass tube. The phosphoric acid distils the more quickly the slower the current of chlorine and carbon tetrachloride.

Phosphoric acid does not distil, even in traces, when magnesium phosphate is heated alone or in admixture with wood charcoal in a current of dry ammonia at a bright red heat (compare Heraeus, Abstr., 1903, ii, 82). Ammonium phosphate, on the other hand, volatilises partly in a current of ammonia, but does not attack the glass tube as when distilled in a current of carbon dioxide; the ammonium phosphate leaves a residue of vitreous phosphoric acid, which is almost insoluble in water or mineral acids.

When heated in a current of carbon tetrachloride at a moderate red heat, ferric phosphate is completely volatilised; if the cool end of the tube is packed loosely with glass-wool, ferric chloride is here deposited quantitatively, whilst the mixture of phosphorus trichloride and oxychloride, formed according to the equation

$$P_2O_5 + 2CCl_4 = PCl_3 + POCl_3 + 2CO_2 + 2Cl,$$

is readily driven over into the receiver. G. Y.

Hydrates of the Phosphoric Acids. Henri Giran (*Compt. rend.*, 1908, **146**, 1270—1272).—The freezing-point curve of aqueous solutions of orthophosphoric acid shows two minima and a single maximum. The minima characterise two eutectics of the composition ($H_3PO_4,0{\cdot}135H_2O$), m. p. 22·5°, and ($H_3PO_4,3{\cdot}205H_2O$), m. p. −81°. The maximum at 29° indicates the existence of the hydrate

$$(H_3PO_4,\tfrac{1}{2}H_2O),$$

for which Joly found m. p. 27° (compare Abstr., 1885, 482). The freezing-point curve for pyrophosphoric acid is similar in form. The two eutectics correspond with the formulæ ($H_4P_2O_7,1{\cdot}25H_2O$), m. p. 23°, and ($H_4P_2O_7,6{\cdot}87H_2O$), m. p. −75°. The maximum characterises the hydrate ($H_4P_2O_7,1{\cdot}5H_2O$), m. p. 26°. This compound has been isolated as unstable needles, readily undergoing conversion into orthophosphoric acid. Measurement of its heat of dissolution proves it to be less stable than the hydrate of orthophosphoric acid.

Only a small portion of the curve for metaphosphoric acid can be studied, since solutions containing less than 63% of water are converted on cooling into a vitreous mass, which refuses to crystallise.

W. O. W.

Molecular Weights of the Phosphoric Acids determined by Cryoscopy. HENRI GIRAN (*Compt. rend.*, 1908, **146**, 1393—1396).—The molecular weights of metaphosphoric and pyrophosphoric acids in acetic acid solution diminish after a lapse of time, and finally reach a limit depending on the concentration of the solution. From extrapolation in the curve representing variation of molecular weight with age of solution, it is found that at the moment of solution, metaphosphoric acid has a molecular weight corresponding with the formula $5(HPO_3)$, whilst pyrophosphoric acid has the formula $3(H_4P_2O_7)$. The molecular weight of orthophosphoric acid varies only slightly with time; the values obtained varied from 111·9 to 127·1, according to the concentration of the solution. The acid should probably be represented by the formula $(H_3PO_4)_2$. Orthophosphoric and pyrophosphoric acids have the same molecular weights in the liquid as in the solid form.

W. O. W.

The Removal of Arsenic from Liquids and Gases. CHEMISCHE FABRIK GRIESHEIM-ELEKTRON (D.R.-P. 194864).—In order to free a liquid, such as concentrated sulphuric acid, from arsenic, it is treated with strong hydrochloric or hydrofluoric acid, and then mixed intimately with benzene. On drawing off the latter liquid, it is found to contain all the arsenic as chloride or fluoride, and, when freed from this impurity by treatment with water, it may be employed in removing arsenic from further quantities of sulphuric acid. Dichlorobenzene may also be employed for this purpose, and, owing to its higher boiling point, is preferably used in the removal of arsenic from gases by allowing it to flow down towers through which the gaseous mixtures are passing.

G. T. M.

Ammoniacal Arsenic Trichloride. ADOLPHE BESSON and GEORGES ROSSET (*Compt. rend.*, 1908, **146**, 1266—1267. Compare Abstr., 1890, 1052; Hugot, Abstr., 1904, ii, 559).—When dry, gaseous ammonia acts on arsenic trichloride at – 20°, a bright yellow solid, $AsCl_3,4NH_3$, is formed; this sublimes completely when heated in a vacuum at 200°, forming a yellow, horn-like substance, $2AsCl_3,7NH_3$. When the former compound is treated with liquid ammonia, it loses its colour, and remains colourless when the excess of ammonia is driven off. When extracted with liquid ammonia, ammonium chloride is removed and a white, insoluble residue obtained, the composition of which agrees with that of the imide, $As_2(NH)_3$. On making an intimate mixture of the portions soluble and insoluble in liquid ammonia, a substance is obtained which differs from the original compound in that it is not completely volatile at 200°, and when treated with sulphuric acid yields only a small quantity of arsenic trichloride.

These experiments lead to the conclusion that liquid ammonia acts on the compound $AsCl_3,4NH_3$ as a reagent, and not merely as a solvent. Arsenic trichloride also reacts with $AsCl_3,4NH_3$, giving rise to ammonium chloride and a substance or mixture of substances, the composition of which is indicated approximately by the formula $As_4Cl_5N_2H_4$. The identity of this product has not been established.

W. O. W.

Tellurides of Arsenic and Bismuth. Cryoscopic Constant of Tellurium. Henri Pélabon (*Compt. rend.*, 1908, **146**, 1397—1400).—Arsenic dissolves readily in molten tellurium. Examination of the freezing-point curve of the solution indicates the existence of the compound As_2Te_3, characterised by a maximum at 362°. This telluride crystallises in long, silver-white needles having a pale yellow tint. The freezing-point curve for solutions of bismuth in tellurium has been completely followed. A maximum occurs at 583°, corresponding with the compound Bi_2Te_3. The freezing points of solutions of these two tellurides in excess of tellurium have been determined, and the cryoscopic constant of tellurium calculated. The value $K = 517$ was obtained from As_2Te_3, whilst the bismuth compound gave $K = 528$. These numbers agree closely with those already determined for this constant.

By applying Robertson's formula (Trans., 1902, **81**, 1233), the latent heat of fusion of tellurium is found to be 20—21 Cal.

W. O. W.

Synthesis of Boron Sulphide from Ferroboron and Manganoboron. Josef Hoffmann (*Zeitsch. anorg. Chem.*, 1908, **59**, 127—135. Compare Abstr., 1907, ii, 82).—The formation of boron sulphide by passing a current of dry hydrogen sulphide over ferroboron and manganoboron at the melting point of antimony has been examined in detail. The ferroboron is more rapidly decomposed than the manganoboron, and a better yield is obtained with the former material. In both cases, only a portion of the contained boron can be converted into the sulphide.

Boron sulphide loses weight on exposure to the air, and hydrogen sulphide is evolved. It also changes when kept in the dark in closed vessels. Water, alcohol, and aqueous solutions decompose it rapidly. It is insoluble in carbon disulpide, and is decomposed slowly by ethyl ether and glycerol. Sulphuric acid reacts with the liberation of hydrogen sulphide and sulphur dioxide.

The author has attempted to ascertain whether borides of definite composition are present in the materials used in his experiments by decomposing these by treatment with aqua regia. The proportions of the constituents which pass into solution are supposed to indicate borides of the composition Fe_3B_4 and MnB. H. M. D.

Preparation of Boron Nitride and Calcium Boride. Alfred Stock and Walter Holle (*Ber.*, 1908, **41**, 2095—2099).—Boron nitride, although easily prepared, is difficult to obtain in a pure state (Stock and Blix, Abstr., 1901, ii, 650; Moeser and Eidmann, Abstr., 1902, ii, 206). It is now found that boron nitride can be prepared by dropping boron bromide into liquid ammonia and gradually heating the resulting boronimide (Joannis, Abstr., 1904, ii, 654) to 750°. Boron nitride, so prepared, reacts only slowly with water, being dissolved in boiling water in one day. In comparison with this, however, phosphorus nitride is highly stable, only about 1% being dissolved by boiling water in two hundred hours. In a glass tube at 180°, phosphorus nitride is completely dissolved by boiling water in a few hours, but in this case the alkali of the glass may be concerned.

The action of calcium on boron trioxide leads to the formation of almost pure calcium boride, and not to that of boron, as stated by Moissan (Abstr., 1899, ii, 153). G. Y.

Pure Carbon Dioxide. Walter P. Bradley and C. F. Hale (*J. Amer. Chem. Soc.*, 1908, **30**, 1090—1096).—In connexion with a study of the critical state of carbon dioxide (Bradley, Browne, and Hale, Abstr., 1905, ii, 75), it was necessary to prepare the gas in the highest possible degree of purity. A method was therefore devised, and is described in the present paper, by means of which carbon dioxide can be obtained of such purity that only 1 part in 30,000—40,000 parts is incapable of absorption by potassium hydroxide solution. The gas is evolved by the action of pure sulphuric acid on sodium hydrogen carbonate, and special apparatus has been devised for its purification and collection. For details, the description and diagram in the original must be consulted.

In the course of the experiments, it was observed that rubber tubing is slightly permeable to air, even against a pressure of 50 mm. of mercury. E. G.

Tschermak's Method of Preparing Silicic Acids. Otto Mügge (*Centr. Min.*, 1908, 325—326. Compare this vol., ii, 277, 490).—A reply to Tschermak. L. J. S.

Preparation of Argon from Air by means of Calcium Carbide. Franz Fischer and Oskar Ringe (*Ber.*, 1908, **41**, 2017—2030).—It is shown that argon can be obtained economically from air by means of calcium carbide. The nitrogen and oxygen are both absorbed when the air is passed over a mixture of calcium carbide (90%) and calcium chloride (10%) heated at 800° in an iron vessel. The nitrogen reacts with the carbide, yielding carbon and calcium cyanamide; the oxygen forms lime and carbon; carbon monoxide and dioxide are also formed, but these ultimately react with the carbide, yielding carbon. The carbide mixture is first heated under reduced pressure in order to remove moisture from the calcium chloride, and then dry air is passed over. The issuing gas contains small amounts of hydrogen, hydrocarbons, and carbon monoxide, and is therefore passed through a vessel containing heated copper oxide. By this process, some 11 litres of argon may be obtained in the course of two days, using about 7 kilograms of carbide.

Details of the apparatus and its use are given. J. J. S.

Percentage of the Inactive Gases in the Atmosphere. A Correction to Previous Calculations. Sir William Ramsay (*Proc. Roy. Soc.*, 1908, **80**, *A*, 599).—The total weights of krypton and xenon in the atmosphere calculated from the volumes (Abstr., 1903, ii, 476) are ten times too small; the true values are 0·028% for krypton and 0·005% for xenon. The values for the proportion of helium and neon previously given (Abstr., 1905, ii, 817) are 100 times too small;

the true percentage of helium is 0·000056 by weight and 0·00040 by volume; of neon, 0·00086 by weight and 0·00123 by volume. G. S.

Preparation of Alcoholic Potassium Hydroxide Solution which will Keep. FRANZ RABE (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 730—731).—It is recommended that the required quantity of potassium hydroxide should be dissolved in its own weight of water, and the solution, when cold, poured into about 900 c.c. of 95% alcohol, with constant shaking. The whole is then diluted with alcohol to 1000 c.c., mixed, and placed aside until the oily drops of "aldehyde-resin" have separated. The solution is then decanted, and, at the end of about two days, is once more poured off from the separated precipitate (potassium carbonate, &c.). Filtration is unnecessary. W. P. S.

Electrolytic Production of Alkali Chlorates and Perchlorates. M. COULERU (D.R.-P. 195639).—In the ordinary electrolytic processes for chlorates, the production of free alkali hydroxide and hypochlorites diminishes the yield of the required salts. Increased efficiency is gained by the addition of calcium salts, chromates, or dichromates. The addition of chromate may be made in alkaline, neutral, or acid solution, the best effect being obtained in the last case and the worst in the first. Practically, however, the employment of an acid solution has two disadvantages, namely, corrosion of the platinum electrodes and formation of a highly-coloured product. Accordingly, the electrolytic solution is kept neutral by the addition of salts which will interact with any alkali hydroxide to furnish either a hydroxide not affected by hypochlorite, or one which will yield a technically important product when treated with this oxidising agent. Magnesium chloride is the best example of the first type of salt, and lead chloride of the second. In the first instance, the magnesium hydroxide which is precipitated by potassium or sodium hydroxide is not materially affected by hypochlorite, and in the second, the lead hydroxide precipitated by the alkali is oxidised by hypochlorite to lead dioxide. The yield calculated on the current employed is 90% for potassium chlorate and 85% for the corresponding sodium salt.

G. T. M.

Preparation of Anhydrous Sodium Thiosulphate and Hydrosulphide. VEREIN CHEMISCHER FABRIKEN IN MANNHEIM (D.R.-P. 194881 and 194882).—Dry pulverulent sodium hydrosulphide results when hydrogen sulphide is passed over sodium sulphide at 300°. If the gas contains carbon dioxide, the sodium sulphide is mixed with the calculated amount of powdered chalk.

Anhydrous sodium thiosulphate is produced by passing oxygen or air over sodium hydrosulphide at 100—150°; it is also formed when sodium sulphide is heated at higher temperatures in a current of hydrogen sulphide and oxygen. G. T. M.

Preparation of Sodium Perborate. DEUTSCHE GOLD & SILBER SCHEIDE ANSTALT (D.R.-P. 193722).—A 50% solution of sodium peroxide prepared in the cold is saturated with carbon dioxide and then treated with a concentrated solution of sodium metaborate. Sodium perborate separates when the liquid is cooled to 2°, providing that sufficient water is present to keep all the alkali carbonate in solution. G. T. M.

Manufacture of Lithia from Lepidolite. William Jay Schieffelin and Thomas W. Cappon (*J. Soc. Chem. Ind.*, 1908, **27**, 549—550).—A 97—99% decomposition of lepidolite can be effected by gradually heating a mixture of the ore with 10% more than its weight of sulphuric acid (66° B.) at 340°, the operation lasting about eight hours. The mass is leached with water and the silica separated; the solution is then treated with sufficient potassium sulphate to convert all the aluminium sulphate into alum. After six days, the mother liquor is decanted from the precipitated alum meal. In order to remove the alum still in solution, the liquid is first treated with whiting to neutralise the acid, and then boiled with freshly-precipitated aluminium hydroxide; practically all the alum is thereby precipitated as basic alum or alunite. A subsequent treatment with more whiting removes the last traces of alumina. The solution is then made alkaline with slaked lime and concentrated; it consists chiefly of lithium sulphate, a small amount of calcium sulphate, and traces of manganese and iron oxides. After removal of these impurities, the solution is added to potassium carbonate, and the precipitated lithium carbonate is then washed and dried. P. H.

Electrolytic Production of Ammonium Persulphate. Consortium für Elektrochemische Industrie (D.R.-P. 195811).—Hitherto a good yield of ammonium persulphate has been obtained electrolytically either by the use of a diaphragm or by the addition of a chromate in ammoniacal solution. It has now been found that a saturated solution of ammonium sulphate can be electrolysed so as to give a good yield of persulphate, provided that a current density of not less than 20 amperes per sq. dcm. is employed, and that the solution is sufficiently acid not to develop an alkaline reaction in the neighbourhood of the cathode. With a current density of 300 amperes, a yield of 70% of persulphate is obtained without the use of a diaphragm. G. T. M.

Double Chromates of Ammonium. Max Gröger (*Zeitsch. anorg. Chem.*, 1908, **58**, 412—426. Compare Abstr., 1907, ii, 94, 624).—The compounds in question were prepared almost exclusively by the gradual addition of 10 c.c. of a $2N$ solution of the appropriate salt to 50 c.c. of an approximately $2N$-solution of neutral ammonium chromate; the precipitate was allowed to remain in contact with the mother liquor for some time, then filtered rapidly, and dried on a porous plate. As many of the salts are decomposed by water, they could not be purified by washing.

Ammonium barium chromate, $BaCrO_4,(NH_4)_2CrO_4$, forms light yellow, cubic crystals, and the corresponding *strontium* salt, light yellow, spherical, crystalline aggregates; both are decomposed by water. The corresponding *magnesium* salt, with $2H_2O$, forms yellow crystals, and is not decomposed by water.

From zinc chloride and neutral ammonium chromate solution, the *compound*, $4ZnCrO_4,2(NH_4)_2CrO_4,3NH_3,3H_2O$, was obtained in transparent, dark yellow, spherical granules, but with a chromate containing ammonia in excess, the compound $ZnCrO_4,(NH_4)_2CrO_4,2NH_3$, already described by Briggs (Trans., 1903, **83**, 391), was obtained. Two double salts containing *cadmium*, of the probable formulæ $2CdCrO_4,2(NH_4)_2CrO_4,NH_3,3H_2O$ (deep-yellow prisms) and

$$CdCrO_4,NH_3,H_2O$$

(small, granular crystals), were also prepared. When the chromate contains excess of ammonia, the compound $CdCrO_4,(NH_4)_2CrO_4,2NH_3$ separates in light yellow, prismatic crystals (Briggs, *loc. cit.*). Two *mercury* salts were also prepared, but their constitution has not been elucidated, and they were probably impure.

With cupric chloride and the chromate containing excess of ammonia, the compound $CuCrO_4,(NH_4)_2CrO_4,2NH_3$ was obtained (Briggs, *loc. cit.*); with the neutral chromate, the same salt in an impure condition was isolated. With nickel chloride and excess of ammonium chromate, a double salt, $2NiCrO_4,2(NH_4)_2CrO_4,3NH_3,H_2O$, has been obtained in small, reddish-brown prisms. Other double salts, obtained by interaction of these two reagents under different conditions, have been described previously. With cobalt chloride, the *compound*, $3CoCrO_4,(NH_4)_2CrO_4,2NH_3,3H_2O$, was obtained in dark reddish-brown granules, readily decomposed by water. With silver nitrate, the *compound*, $3Ag_2CrO_4,(NH_4)_2CrO_4$, was obtained in reddish-brown, granular crystals, and with lead acetate, the *compound*, $PbCrO_4(NH_4)_2CrO_4$, as an amorphous precipitate; both compounds are decomposed by water.

G. S.

The Solubility of Silver Iodide in Ammonia. HENRI BAUBIGNY (*Compt. rend.*, 1908, **146**, 1263—1265; *Bull. Soc. chim.*, 1908, [iv], **3**, 772—775).—The solubility of silver iodide in aqueous ammonia increases appreciably with rise of temperature. Failure to take this into account is responsible for the discordant results of previous observers. The author shakes known weights of silver iodide (free from chloride) with a definite volume of ammonia in sealed tubes at 50—60°, and, after allowing these to cool to the desired temperature, observes whether or no crystallisation has taken place. In this way, the coefficient of solubility of silver iodide at 16° in aqueous ammonia (D 0·926) is found to be of the order 1/6000, a value considerably lower than that obtained by previous workers.

W. O. W.

Simplest Method of Preparing Carey Lea's Photo-haloids. LÜPPO-CRAMER (*Zeitsch. Chem. Ind. Kolloide*, 1908, **2**, 360—361).—When the halogen salts of silver are allowed to remain in contact, or are warmed, with colloidal solutions of silver, the so-called "photo-salts" are formed. These are separated by dissolving the excess of colloidal silver in nitric acid. The coloured halogen salts are also obtained when a suitable reducing agent is added to silver nitrate which is in contact with the ordinary silver halogen salts. Suitable reducing agents are (1) sodium citrate + ferrous sulphate; (2)

sodium potassium tartrate + ferrous sulphate; (3) tannic or gallic acid + alkali carbonate; (4) formaldehyde + sodium hydroxide; (5) sodium hypophosphite.

The method of preparation described supports the author's view that the coloured salts are adsorption compounds. H. M. D.

[Preparation of Calcium Hypochlorites.] Chemische Fabrik Griesheim-Elektron (D.R.-P. 195896).—When a mixture of 1 part of quicklime and 6·4 parts of water is treated with chlorine until nearly all the lime is used up, a solution is obtained containing 180 to 190 grams of active chlorine and only 1 or 2 grams of chlorate per litre. This solution is then treated anew with lime and chlorine, when crystalline calcium hypochlorite is deposited. This operation may be repeated until nearly all the hypochlorite is precipitated, the action being accelerated by the addition of calcium chloride.

When milk of lime is chlorinated, a point is reached at which further introduction of chlorine does not increase the amount of active chlorine in solution, owing to the formation of basic hypochlorites of the type $Ca(OCl)_2,xCa(OH)_2$. Two have been isolated in which x i 2 and 4; they cannot be obtained crystalline, owing to the circumstance that they are decomposed by water. G. T. M.

Colloidal Barium Sulphate. Albert Recoura (*Compt. rend.*, 1908, **146**, 1274—1276. Compare Neuberg, Abstr., 1906, ii, 753).—The employment of pure glycerol as a solvent for the reacting salts when barium sulphate is prepared by double decomposition, results in the formation of a stable colloidal variety of the latter substance. The glycerol solution of the colloid can be diluted with several times its volume of water without bringing about precipitation of the insoluble form. The solution is, however, immediately coagulated on boiling. The addition of aqueous solutions of metallic salts (with the exception of mercuric chloride and salts of barium) likewise causes precipitation. Ammonia, baryta, and all monobasic acids, after several hours, bring about a gradual precipitation, whilst polybasic acids (boric acid excepted) cause immediate coagulation. Barium salts increase the stability of the colloid to a marked extent. A solution which has been rendered stable by the addition of barium nitrate can be kept for fifteen days to a month without depositing barium sulphate. Such a solution, however, is immediately coagulated by the addition of salts of polybasic acids; the salts of monobasic acids on the other hand are without action on it. W. O. W.

Langbeinite and Vanthoffite [$K_2SO_4,2MgSO_4$ and $3Na_2SO_4,MgSO_4$]. Richard Nacken (*Chem. Zentr.*, 1908, i, 1850; from *Nachr. K. Ges. Wiss. Göttingen*, 1907, 602—613. Compare Abstr., 1907, ii, 530).—The author has studied the temperature-concentration diagram of the systems $MgSO_4$–K_2SO_4 and $MgSO_4$–Na_2SO_4 as in previous cases.

1. *Simple sulphates.*—Sodium sulphate and potassium sulphate are enantiotropic dimorphous, with transformation temperatures 234° and 595°, and m. p. 883° and 1076° respectively; they do not

appreciably decompose or volatilise. Magnesium sulphate is considerably decomposed below its m. p., 1124°.

2. *Magnesium sulphate–potassium sulphate system.*—The solidification curve shows a maximum at 33·3 mol.% K_2SO_4 and 930°. Both artificial and natural langbeinite exhibit simple refraction, D^{25} 2·829. The eutectic mixture, $MgSO_4$ + langbeinite, m. p. 884°, contains 22 mol.% K_2SO_4. α-K_2SO_4 in the solid state is miscible with $MgSO_4$ to a limited extent. The eutectic mixture, langbeinite + saturated α-K_2SO_4, mixed crystals, m. p. 747°, contains 62 mol.% K_2SO_4.

3. *Magnesium sulphate–sodium sulphate system.*—The maximum concentration of this mixture has been found to be $Na_2SO_4,3MgSO_4$, m. p. 813°, D^{25} 2·0345, double refracting granules, and not as is stated by Le Chatelier, $Na_2SO_4,2MgSO_4$. Eutectic mixture, $MgSO_4 + Na_2SO_4,3MgSO_4$, 808° and 23 mol.% Na_2SO_4. α-Na_2SO_4 in solid form is miscible with $MgSO_4$ to a limited extent. Eutectic mixture, $Na_2SO_4,3MgSO_4$ + saturated α-Na_2SO_4, mixed crystals, 665° and 52 mol.% Na_2SO_4. Natural vanthoffite shows an alteration in refraction at 489°, and has the same D^{25} 2·6955 as the artificial. J. V. E.

Double Chlorides and Bromides of Zinc and the Alkalis.

FRITZ EPHRAIM (*Zeitsch. anorg. Chem.*, 1908, **59**, 56—70).—The products obtained by crystallisation of solutions containing chlorides and bromides of zinc and sodium, potassium, ammonium, or lithium at temperatures between about 20° and 100° have been examined.

The salt, $2KCl,ZnCl_2,H_2O$, crystallises from a solution containing a slight excess of zinc chloride. On leaving the mother liquor for some days in contact with the air, the salt, $KCl,ZnCl_2$, separates in thick, monoclinic prisms. Solutions containing potassium chloride in considerable excess, deposit this on evaporation, and later the anhydrous double chloride, $2KCl,ZnCl_2$, appears.

The salt, $KBr,ZnBr_2,2H_2O$, crystallises from solutions containing equal molecular proportions of the two bromides in elongated, six-sided tablets. Solutions containing 2 or more mols. of potassium bromide per mol. of zinc bromide yield very fine, hair-like needles of the composition $2KBr,ZnBr_2,2H_2O$.

The already-described sodium zinc chloride, $2NaCl,ZnCl_2,3H_2O$, is the only double chloride which can be separated.

The salt, $NaBr,ZnBr_2,H_2O$, crystallises from solutions containing zinc bromide in slight excess in hygroscopic prisms. The salt $2NaBr,ZnBr_2,5H_2O$ is obtained in the form of small needles from solutions containing the two bromides in the same ratio.

In addition to the double chlorides and bromides of ammonium and zinc previously described, a substance of the composition

$$NH_4Br,ZnBr_2,xH_2O$$

is obtained on evaporation of a solution containing equal molecular quantities of the simple bromides.

On evaporation of a solution containing 2 mols. zinc chloride per mol. lithium chloride, microscopic, six-sided leaflets of the basic salt, $ZnO,3ZnCl_2,H_2O$, separate. By slow evaporation of the mother liquor over concentrated sulphuric acid, crystals of the composition $LiCl,ZnCl_2,3H_2O$ are obtained. From solutions containing 2 mols.

lithium chloride per mol. zinc chloride, well-formed, hygroscopic, flat prisms of the composition $2LiCl,ZnCl_2,2H_2O$ crystallise.

When a solution containing 6 mols. of lithium chloride per mol. of zinc chloride is evaporated on the water-bath and cooled, lithium chloride separates; on repeating these processes until no more lithium chloride crystallises on cooling, a syrupy liquid of the composition $3LiCl,ZnCl_2,10H_2O$ is obtained. This liquid, which does not lose water at 100° and does not crystallise when cooled to $-20°$, is supposed to be a definite compound. The syrupy liquid, after having been kept in a desiccator for about six months, deposited crystals of lithium chloride. H. M. D.

Rare Earths. HUGO ERDMANN and FRITZ WIRTH (*Annalen*, 1908, **361**, 190—217).—The peculiar behaviour of cerium with 1 : 8-hydroxynaphthalenesulphonic acid (Erdmann and Nieszytka, this vol., i, 621) led the authors to study the salts of this acid with other rare earths, as also the malonates, which, like the oxalates, serve for the recognition and separation of rare metals, since the malonates of the cerium metals are isomorphous and microcrystalline, whilst those of the yttrium earths crystallise in long spears. The sulphides of samarium and gadolinium have also been prepared.

Neodymium and samarium are separated from lanthanum and praseodymium by a long series of fractional crystallisations of didymium magnesium nitrate, $2R(NO_3)_3,3Mg(NO_3)_2,24H_2O$, which crystallises in large plates (Demarçay, Abstr., 1900, ii, 346). Lanthanum is then separated from praseodymium by Welsbach's method of fractional crystallisation of the double salts with ammonium nitrate. Samarium and gadolinium nitrates were prepared from a euxenite and from the final filtrates from the preparation of neodymium, the samarium being precipitated as the double salt with potassium sulphate, $2Sa_2(SO_4)_3,9K_2SO_4,3H_2O$, which crystallises from concentrated potassium sulphate solution. Europium was removed from this precipitate by Urbain and Lacombe's method (Abstr., 1904, ii, 43). The gadolinium which remains dissolved in the potassium sulphate solution was purified by fractional precipitation of the nitrate from nitric acid. The examination of the arc spectra showed that the samarium nitrate was free from neodymium, and therefore from the metals of the cerium group, but contained traces of gadolinium, europium, and yttrium; the gadolinium fraction contained only traces of samarium, dysprosium, terbium, and yttrium.

Malonates of the Rare Earths.—As malonic acid does not form precipitates with the salts of the rare earths, malonates were prepared by the action of malonic acid on the hydroxides; on heating the aqueous solutions, the malonates separate in crystalline form. The following malonates are described (compare Holmberg, Abstr., 1907, ii, 90); the figures in brackets are the solubilities in 100 parts of water at 18°: $(C_3H_2O_4)_3La_2,5H_2O$ (0·0455), white crystals; $(C_3H_2O_4)_3Ce_2,5H_2O$ (0·0141), white crystals, lose $2H_2O$ at 140°, and the remaining $3H_2O$ at 180°; $(C_3H_2O_4)_3Pr_2,6H_2O$ (0·0179), green, crystalline powder; $(C_3H_2O_4)_3Nd_2,5H_2O$ (0·0354); $(C_3H_2O_4)_3Sa_2,6H_2O$ (0·0397), yellow, granular powder; $(C_3H_2O_4)_3Gd,8H_2O$ (0·0616), strongly refracting, yellow needles; $(C_3H_2O_4)_3Yt_2,5H_2O$ (0·1076), white needles;

$$(C_3H_2O_4)_3Er_2,10H_2O$$

(0·1300), long needles. The malonates of the cerium group form prismatic, doubly refracting plates, and effloresce in air; those of the yttrium group form doubly refracting, rhombic needles. All of these salts dissolve in acids, and when boiled with alkalis form the hydroxide of the metal.

8-*Hydroxynaphthalene*-1-*sulphonates of the Rare Earths.*—The following 8-hydroxynaphthalene-1-sulphonates were prepared by the action of the acid on the carbonates of the rare metals; they separate from the boiling aqueous solution as heavy powders. The solubilities in 100 parts of water at 14° are given in brackets: $(C_{10}H_6SO_4)_3La_2$ (0·0926—0·0987), white powder, dissolves in acids, forming bluish-red solutions; $(C_{10}H_6SO_4)_3Pr_2$ (0·0709—0·0818), green powder, forms bluish-red solutions in acids; $(C_{10}H_6SO_4)_3Nd_2$ (0·0171—0·0211), grey powder, forms yellowish-red solutions in acids; $(C_{10}H_6SO_4)_3Sa_2$ (0·0496—0·0573), white powder, soluble in acids; $(C_{10}H_6SO_4)_3Gd_2$ (0·117), white powder, forms bluish-red solutions in acids;

$$(C_{10}H_6SO_4)_3Yt_2$$

(0·0951), white powder, forms bluish-red solutions in acids;

$$(C_{10}H_6SO_4)_3Er_2$$

(0·0339), white powder. These salts are not hygroscopic, but absorb oxygen, becoming black on exposure to air; when boiled with alkalis, they form metallic hydroxides.

Sulphides of the Rare Earths.—These are best prepared by heating the sulphates in a current of hydrogen sulphide (Muthmann and Stützel, Abstr., 1900, ii, 142).

Samarium sulphide, Sa_2S_3, forms a yellow mass, D 3·7, burns when heated, forming the oxide and sulphate, is decomposed only slowly by boiling water, and dissolves in acids with evolution of hydrogen sulphide.

Gadolinium sulphide, Gd_2S_3, forms a hygroscopic, yellow mass, D 3·8, and behaves in the same manner as the samarium salt.

G. Y.

Scandium. Sir William Crookes (*Proc. Roy. Soc.*, 1908, **80**, *A*, 516—518).—As the result of spectroscopic examination of fifty-three rare-earth minerals, scandium has been detected in auerlite, cerite, keilhauite, mosandrite, orangite, orthite, pyrochlore, thorianite, thorite, and wiikite. All these minerals contain less than 0·01% of scandium, except wiikite, which contains more than 1%.

Wiikite is a black, amorphous mineral, which, when heated to redness in a silica tube, gives off helium, water, hydrogen sulphide, a white sublimate, and traces of hydrogen, carbon dioxide, and neon. An approximate analysis of wiikite gave the following figures: tantalic acid with some niobic acid, 15·91; titanic acid and zirconia, 23·36; earths of the cerium group, 2·55; earths of the yttrium group, 7·64; scandia, 1·17; thoria, 5·51; ferrous oxide, 15·52; uranic oxide, 3·56; silica, 16·98; water and gases, 5·83; calcium, manganese, tin, sulphur, &c., 1·97.

Scandium may be separated by fractional crystallisation from the crude earths, consisting chiefly of yttria, ytterbia, and scandia; its spectrum should be free from the lines of ytterbium.

A number of salts of scandium have been prepared and analysed.

R. J. C.

New Double Salt of Thallium. Moritz Kohn (*Zeitsch. anorg. Chem.*, 1908, 59, 111—113).—When a hot concentration solution of thallous sulphate is added to a solution containing an equal molecular quantity of uranyl sulphate acidified with sulphuric acid, intensely-coloured, yellow crystals of the double salt, $Tl_2SO_4,UO_2SO_4,3H_2O$, belonging to the rhombic system, separate on cooling. Solutions supersaturated with regard to the double salt are easily obtained.

H. M. D.

Freezing-point Diagrams of the Binary Systems, Cu–Cu_2Se, Ag–Ag_2Se, and Pb–PbSe. K. Friedrich and A. Leroux (*Metallurgie*, 1908, 5, 355—358).—The addition of selenium lowers the freezing point of copper, the eutectic point lying between 2 and 3% Se and 1063°. The curve then rises, soon becoming nearly horizontal. There is some separation into two liquid layers, the limits of which were not determined. The existence of copper selenide, Cu_2Se, melting at 1113°, is demonstrated. Copper does not form solid solutions with selenium.

Mixtures of silver with more than 7% Se separate into two liquid layers. The existence of the selenide Ag_2Se (m. p. between 834° and 850°) is indicated, but mixtures richer in selenium could not be prepared, owing to loss by volatilisation.

Only a single branch of the freezing-point curve of lead–selenium mixtures could be determined. The eutectic point lies close to the lead end. The existence of the compound PbSe, m. p. 1100°, is indicated.

C. H. D.

Non-electrolytic Solution of Mercury in Water and Other Liquids. A. Christoff (*Zeitsch. physikal. Chem.*, 1908, 63, 346—354).—Experiments show that mercury can dissolve in, and diffuse through, water which contains air, nitrogen, carbon dioxide, sulphuric acid, or potassium hydroxide, as also through benzene, nitrobenzene, and alcohol. The mercury was covered with a layer of water (or other liquid), and the fact of its diffusion was proved by the reduction of a gold chloride solution contained in a separate vessel (compare Barfoed, Abstr., 1889, 346). In some cases, the mercury was exposed to the air, and the gold chloride solution was protected by a water seal. It is shown, also, that mercury left for a long time in contact with water suffers a slight loss in weight, although no mercury compounds can be detected in the water.

J. C. P.

Two Observations Relating to the Decomposition of Mercuric Iodide. Moritz Kohn (*Zeitsch. anorg. Chem.*, 1908, 59, 108—110).—In alkaline solution, mercuric iodide is decomposed quantitatively by sodium arsenite, with the separation of metallic mercury. After the solution containing an excess of arsenite has been heated to the boiling point, it is left for several hours, and the separated mercury can then be filtered off. Estimation of the iodide in the solution shows that the reaction is quantitative.

Hydrogen peroxide also liberates metallic mercury from mercuric iodide in alkaline solution. The mercury can be filtered off after one to two hours. The decomposition is not quite complete in this case.

H. M. D.

The Alumino-Silicate, $K_2Al_2SiO_6$. ZYGMUNT WEYBERG (*Centr. Min.*, 1908, 326—330).—Gorgen's method (Abstr., 1890, 13) for preparing the crystalline compound $K_2Al_2SiO_6$ was tried, but better results were obtained by fusing kaolin with a large excess of potassium dichromate. The minute, colourless, isotropic octahedra which result are, however, much contaminated by enclosures of crystallised chromic oxide. Attempts to obtain other salts of the acid, $H_2Al_2SiO_6$, were unsuccessful. L. J. S.

The Potassium Alumino-Silicate, $K_2Al_2Si_2O_8$. ZYGMUNT WEYBERG (*Centr. Min.*, 1908, 395—402).—By fusing kaolin or a mixture of alumina and silica with a large excess of potassium salts (chloride, carbonate, sulphate, or chromate), a minutely-crystalline product with the composition $K_2Al_2Si_2O_8$ is obtained. The crystals appear to be of two kinds (possibly tetragonal and orthorhombic), and to differ from the hexagonal mineral kaliophilite. L. J. S.

Preparation of Manganese Compounds. O. DIEFFENBACH (D.R.-P. 195523 and 195524).—The reactivity of naturally-occurring manganese dioxide is greatly increased when it is hydrated by heating under pressure at 188° with 30% sodium hydroxide solution. The product which is obtained in a voluminous form contains the hydrate $MnO_2,2H_2O$.

The decomposition of an alkali manganate in aqueous solution into permanganate, manganese dioxide, and alkali hydroxide can be reversed when manganese dioxide suspended in 30% to 40% potassium hydroxide solution containing a small amount of manganate or permanganate is electrolysed in the anode compartment of an electrolytic cell. When the mixture is stirred and heated, the manganese dioxide is gradually converted into potassium manganate. Instead of manganate or permanganate, a small amount of potassium ferricyanide may be employed as the oxidising catalyst.

G. T. M.

Alloys of Iron and Carbon. GEORGES CHARPY (*Bull. Soc. chim.*, 1908, [iv], 3, i—xlvi).—A lecture delivered before the Chemical Society of Paris, in which a critical résumé of the results obtained in recent years in the study of iron-carbon alloys is given. The following principal lines of investigation are dealt with: (*a*) deduction of an equilibrium diagram by the application of the phase rule; (*b*) thermal investigations; (*c*) isolation of definite constituents from the alloys by chemical processes; (*d*) microscopic examination, and (*e*) observation of the physical and mechanical properties of the alloys. The limits of applicability of each of these methods, and the special difficulties attending the prosecution of each, are discussed, and the bearing of the results obtained by the last four methods of research on the elaboration of a complete equilibrium diagram are considered in detail, and attention is directed to points still requiring investigation. A bibliography of the subject is appended. T. A. H.

Steels Containing Phosphorus. J. DE KRYLOFF (*Rev. de Métallurgie*, 1908, **5**, 355—360).—The brittleness of steels containing small quantities of phosphorus may be removed by quenching in oil and re-heating to 750°. In this way, a uniform structure is obtained if the phosphorus does not exceed 0·07%. A larger proportion of phosphorus prevents the uniform distribution of ferrite and pearlite. C. H. D.

The Rusting of Iron. J. NEWTON FRIEND (*J. Iron Steel Inst.*, 1908, **77**, i, 5—32. Compare Moody, Trans., 1906, **89**, 729; Proc., 1907, **23**, 84; Tilden, Trans., 1908, **93**, 1356).—Boiling pure iron or steel with distilled water in a Jena glass reflux apparatus for two hours does not dissolve any iron. The contrary result of Walker, Cederholm, and Bent (Abstr., 1907, ii, 875) is to be attributed to the retention of some carbon dioxide by the water. An apparatus was devised in which water could be distilled from sodium hydroxide solution on to iron in a closed bulb, and in this case rusting did not take place. In another apparatus, iron was immersed in pure water, and a current of air free from carbon dioxide bubbled through the apparatus. Rusting did not take place if the iron was protected from contact with the glass, although the admission of ordinary air at once caused rusting. It is considered, in agreement with Moody, that the presence of an electrolyte is necessary to the formation of rust. Cast iron rusts even in pure air and water, probably owing to the oxidation of the sulphide and phosphide present. Pure steam is also without action on pure iron at 100°.

Neutral or alkaline hydrogen peroxide is without action on pure iron, although cast iron is rapidly attacked. Pure iron powder, freed from adhering films of gas, is not acted on by pure water at the ordinary temperature.

Neutral salts of the alkali metals exert a corrosive action, and, if the iron is in immediate contact with glass, local corrosion takes place at the point of contact. C. H. D.

Conductivity of Solutions of Ferric and Ferrous Chlorides and the Structure of Ferric Chloride. WLADIMIR JUFEREFF (*Zeitsch. anorg. Chem.*, 1908, **59**, 82—86).—Measurements have been made of the electrical conductivity of concentrated solutions of the two chlorides of iron. The greater conductivity of the ferric solutions at dilutions greater than about 3·6 litres per mol. is interpreted in terms of an opinion expressed by Spring that ferric chloride in solution has the constitution Fe_2Cl_4,Cl_2. Chlorine is supposed to be set free, and the increased conductivity is attributed to the conversion of this into hydrochloric acid. H. M. D.

Magnetic Oxides of Chromium. IVAN SHUKOFF (*Compt. rend.*, 1908, **146**, 1396—1397).—Chromium trioxide decomposes at 330° with loss of oxygen and development of heat. If the decomposition is controlled so that the temperature does not rise above 500°, the oxides obtained are only feebly magnetic. On heating, however, to 500—510°, 13—14% of oxygen is evolved, and the black mass, which has the composition $2CrO_3,Cr_2O_3$, is strongly magnetic. An oxide of the same composition, but prepared at 485°, was very feebly magnetic. A crystalline magnetic oxide was obtained by the decomposition of chromyl dichloride; when ignited, it loses only 3·4—4% of oxygen. W. O. W.

Molybdo-Uranic Compounds. ANDRÉ LANCIEN (*Chem. Zentr.*, 1908, i, 1763—1764; from *Bull. Sci. Pharm.*, 1908, **15**, 132—140. Compare Abstr., 1907, ii, 697).—When uranium nitrate is added to an excess of ammonium heptamolybdate and the resulting precipitate boiled with molybdic acid, *uranium heptamolybdate*, $7MoO_3,3UO_3$, is obtained as an amorphous, yellow powder. It is soluble in all mineral acids, giving a greenish-yellow, fluorescent liquid; it is decomposed by excess of water, and reduced to green uranium molybdate, $U(MoO_4)_2$, by alcohol and by acetic acid. The effect of sunlight on the heptamolybdate is to darken its colour, and to render it no longer reducible by alcohol or completely soluble in nitric acid, owing to the formation of insoluble anhydrous *uranium octamolybdate*, $8MoO_3,UO_3$. The hydrated compound, $8MoO_3,UO_3,13H_2O$, is obtained as prismatic needles when ammonium heptamolybdate is precipitated by uranium nitrate and the product treated with excess of acetic acid; the substance obtained is extremely sensitive to light. A study has been made of the rate of change of this substance when exposed to light of various wave-lengths. J. V. E.

A New Iodide of Titanium, Titanous Iodide, TiI_2. EDOUARD DEFACQZ and H. COPAUX (*Compt. rend.*, 1908, **147**, 65—67).—Titanium tetraiodide (Hautefeuille, *Bull. Soc. chim.*, 1867, [ii], **7**, 201) is reducible by silver or mercury to a di-iodide. The reduction is most readily effected as follows: Two porcelain boats, the anterior one containing mercury and the posterior one titanium tetraiodide, are introduced into a porcelain tube and heated gradually in a current of hydrogen to dull redness. A sublimate of mercuric iodide and unchanged tetraiodide is formed in the cooled receiver, whilst fine brilliant black lamellæ of *titanous iodide*, TiI_2, are formed near the exit end of the tube. The crystals, which are very hygroscopic, have D^{20} 4·3, are not acted on by organic solvents, are dissolved by concentrated hydrofluoric acid and by boiling hydrochloric acid, forming a blue solution, are violently attacked by nitric and sulphuric acids with loss of iodine, and are decomposed by water and aqueous alkali solutions. Titanous iodide forms additive compounds with dry ammonia and hydrogen chloride. It is reduced by hydrogen at a white heat, but not at a red heat, giving amorphous titanium, which is very readily oxidised.

The analysis was carried out by the method described previously (Abstr., 1898, ii, 521). E. H.

Titanium Nitride and a New Class of Titanium Compounds, the Titaniumnitrogenhaloids. Otto Ruff and Fritz Eisner (*Ber.*, 1908, **41**, 2250—2264).—Wöhler showed originally that a nitride was formed on heating the compound of titanium tetrachloride and ammonia (*Annalen*, 1850, **73**, 43), and described four nitrides. Friedel and Guérin (this Journ., 1877, i, 168) reduced this number to two, Ti_2N_2 and Ti_3N_4. The latter substance has been found by Schneider (Abstr., 1895, ii, 169) to contain less nitrogen than that required by the formula, and he called it nitride *A*. A re-examination of the substance shows that Ti_3N_4 does not exist. The bluish-black product, obtained by heating the compound $TiCl_4,6NH_3$ at the temperature at which Jena glass softens in a stream of ammonia, contains $Ti = 72·1$, $N = 20·77$, $Cl = 2·64$, $O = 4·36$ (Ti_3N_4 requires $Ti = 72·0$, $N = 28·0$). The total titanium was determined by dissolving the nitride in nitric and hydrofluoric acids, and precipitating the titanic acid by ammonia. When the substance is covered with dilute sulphuric and hydrofluoric acids and titrated with *N*/10 potassium permanganate, the nitride goes slowly into solution as the permanganate is reduced. The solution contains hydrochloric and some pertitanic acids; the latter is destroyed by potassium iodide, and the iodine separated estimated by thiosulphate. In this way, Ti, 52·7%, was found. As a blank determination with pure TiN gave 76·9 instead of 77·1, the conclusion is drawn that the 52·7 represents the titanium present in the tervalent condition, and, as the chlorine is supposed to exist as TiNCl, the composition of the Wöhler-Schneider nitride is deduced to be $TiN = 68$, $TiNCl = 7·2$, $(TiN)_2O\,? = 13·3$, and $TiO_2\,? = 5·4$. When this mixture is heated in a current of ammonia at 1500° for six hours, the chlorine and oxygen are removed completely, and pure bronze-coloured titanium nitride, TiN, is obtained, D^{18} 5·1. It could not be converted into the chloronitride by chlorine either at 270° or in the liquid state.

An attempt to prepare the nitride, Ti_3N_4, from the so-called titanamide (Stähler, Abstr., 1906, ii, 595) also resulted in failure. It is also shown that continued extraction of the compound $TiCl_4,6NH_3$ with ammonia in a Stock and Blix apparatus (Abstr., 1901, ii, 650), moisture being excluded, does not give titanamide at all, but a titanochloroamide of the composition $Ti_{1·0}Cl_{1·43}N_{0·86},3·5—5NH_3,0·02TiO_2$. The ammonia is removed by careful heating in a vacuum at 270°, and a dirty green residue of *titanium chloronitride*, TiNCl, is obtained, containing, however, 1·3% nitride and 12—14% titanium oxynitride and titanium dioxide. It is extraordinarily reactive towards water, taking fire and giving ammonium chloride, nitrogen, and titanium dioxide. On further heating, it decomposes, thus: $4TiNCl = 3TiN + TiCl_4 + N$.

Although pure titanium chloronitride was not obtained, the corresponding *bromonitride*, TiNBr, is formed from titanium tetrabromide

(m. p. 39°, b. p. 230°) in a similar manner, the heating of the product obtained on extraction with ammonia being carried out at 200°/4 mm. It also reacts vigorously with water. W. R.

Preparation and Properties of Zirconium Tetrafluoride. LUDWIG WOLTER (*Chem. Zeit.*, 1908, **32**, 606—607).—The method described by Marignac (*Jahresb.*, 1860, 136) for the preparation of zirconium tetrafluoride by heating zirconium dioxide mixed with twice its weight of ammonium hydrogen fluoride, has the disadvantage that this substance volatilises more readily than it attacks the zirconium dioxide. This, however, can be overcome by using, instead of the above mixture, pure zirconium ammonium fluoride, $ZrF_4,2NH_4F$, which is readily prepared in a pure state by evaporating zirconium dioxide with excess of silica-free hydrogen fluoride and ammonia, and subliming the product in a platinum tube in a current of nitrogen.

Theoretical yields of the purest zirconium tetrafluoride are obtained by the action of anhydrous hydrogen fluoride on pure zirconium tetrachloride, the change readily taking place in accordance with the equation $ZrCl_4 + 4HF = ZrF_4 + 4HCl$. The product obtained is snow-white, crystalline, and practically insoluble in water. When sublimed, zirconium tetrafluoride forms small, strongly refracting, prismatic crystals having slightly curved facets, D^{16} 4·4333, and the molecular weight determined by Victor Meyer's method was found to be 166·1, in close agreement with ZrF_4 (166·7). Unlike the other elements of the carbon group, zirconium tetrafluoride is only sparingly soluble in water, 1·388 grams dissolve in 100 c.c. of water without hydrolysis taking place. When warmed to about 50°, the hydrate, $ZrF_4,3H_2O$, is precipitated; in no case could any other hydrate or oxyfluoride be obtained. With liquid ammonia, zirconium tetrafluoride gives a white powder ($5ZrF_4,2NH_3$), whilst with gaseous ammonia, pyridine, hydrogen sulphide, &c., practically no change takes place. It is suggested that this inactivity of the zirconium tetrafluoride compared with other members of the group is perhaps due to its small molecular volume: TiF_4, 44·3; ZrF_4, 37·5; SnF_4, 40·7. J. V. E.

Oxides of Quinquevalent Bismuth. ALEXANDER GUTBIER and H. MICHELER (*Zeitsch. anorg. Chem.*, 1908, **59**, 143—145. Compare Gutbier and Bünz, Abstr., 1906, ii, 174, 234, 551, 678; Ruff, this vol., ii, 298).—The bismuthic acid described by Ruff is entirely different from the substance which is usually referred to by this name in the older literature. In order to avoid confusion, Gutbier and Bünz considered it necessary to retain the name bismuthic acid for a particular product obtained under specified conditions. This substance, which is formed from the dark brown oxidation products (obtained by oxidation of bismuth trioxide in presence of potassium hydroxide solution) by the action of hot concentrated nitric acid, has a colour which varies from scarlet-red to yellowish-red. It has no acid properties, and cannot be obtained from any of the sodium bismuthates which have been described.

In general, the substances obtained by Ruff cannot be compared with those obtained by Gutbier and Bünz. This view is expressed as a result of a repetition of Ruff's experiments by the authors.

H. M. D.

Use of Iridium Crucibles in Chemical Operations. Sir William Crookes (*Proc. Roy. Soc.*, 1908, **80**, *A*, 535—536).—An account is given of the behaviour of pure wrought iridium crucibles during several months' use in ordinary quantitative estimations. Iridium is as hard as steel, and does not blister or alter in weight when repeatedly heated to redness. Heated for some hours in a Bunsen flame with insufficient air supply, the crucible is unharmed, as the deposit of carbon can be entirely burnt away. Sulphur in the gas is also without effect. Boiling aqua regia, fused microcosmic salt, or other phosphates with frequent additions of carbon, strongly heated silica or silicates with a reducing agent, boiling lead at white heat, boiling zinc, and molten nickel, iron, or gold are without effect on the crucible, which, after cleaning, retains its original weight. Fused potassium hydroxide attacks iridium less than platinum, and zinc run in with acid zinc chloride and then heated to boiling only superficially attacks the iridium. Prolonged heating with copper renders the crucible brittle when hot, but the copper can be burnt off.

A rhodium crucible is practically as resistant as an iridium one, and has the advantage of being cheaper and only half as heavy.

R. J. C.

Alkali Iridichlorides and Iridiochlorides. Marcel Delépine. (*Compt. rend.*, 1908, **146**, 1267—1269).—The iridichlorides of potassium, rubidium, caesium, and ammonium, obtained from sodium iridichloride by double decomposition, conform to the type $IrCl_6M_2$. The potassium and sodium salts are black. Large crystals of the ammonium salt are black, but small crystals have a red tint. The rubidium salt varies from brownish-red to brick-red, according to the size of the crystals. The *caesium* salt, $IrCl_6Cs_2$, is bright red and sparingly soluble in water.

The iridiochlorides are readily prepared from the iridichlorides by reduction with a normal oxalate. Thus sodium iridichloride and sodium oxalate yield the very soluble sodium salt, $IrCl_6Na_3,12H_2O$. Aqueous solutions of the *potassium* and *ammonium* salts are decomposed by water, thus, $IrCl_6M_3 + H_2O \rightleftarrows IrCl_5(H_2O)M_2 + MCl$; hence to obtain the trimetallic salts excess of an alkali chloride must be added. The crystals which separate are black, brownish-red, green, or yellow, according to size; on dehydration they become olive-green. The dimetallic iridiochlorides separate from the mother liquor on concentration. The *potassium* salt, $IrCl_5(H_2O)K_2$, crystallises in needles; the *ammonium* salt in octadedra.

Dirubidium aquoiridiopentachloride, $IrCl_5(H_2O)Rb_2$, forms small, thick crystals. The *caesium* salt, $IrCl_5(H_2O)Cs$, crystallises in small, olive needles. Trirubidium iridiochloride crystallises in needles containing $1H_2O$, and not $1\frac{1}{2}H_2O$ as usually represented. The *caesium* salt, $IrCl_6Cs_3,H_2O$, forms bright olive needles.

In accordance with the requirements of Werner's theory for the

constitution of these salts, it is found that the trimetallic salts readily lose their water of crystallisation; the dimetallic salts of the type $IrCl_5(H_2O)M_2$, on the other hand, undergo no change when heated at 150°.
W. O. W.

The Preparation of Alkali Iridiochlorides. Maurice Vèzes (*Compt. rend.*, 1908, **146**, 1392—1393).—A claim for priority (compare Abstr., 1899, i, 572, and Delépine, preceding abstract).
W. O. W.

Mineralogical Chemistry.

An Old Occurrence of Argyrodite at Freiberg. Friedrich Kolbeck (*Centr. Min.*, 1908, 331—333).—A specimen in the A. G. Werner collection at Freiberg was labelled "dunkles Rotgülden," and had been found in 1817 in the Bescheert Glück mine. It is a portion of a large, indistinct crystal with an iron-black colour. On examination, it proved to be the rare mineral argyrodite, in which germanium was discovered. Analysis by T. Döring gave the following results, agreeing with Penfield's formula Ag_8GeS_6:

Ag.	Ge.	Sb.	Fe.	S.	Total
75·28	6·18	0·36	0·33	17·50	99·65

L. J. S.

Vanadium [Sulphide] from Minasragra. José J. Bravo (*Chem. Zentr.*, 1908, i, 1793; from *Oesterr. Zeitsch. Berg-Hüttenwesen*, 1908, **56**, 166—168).—In an inclined strata of impure carbon of an asphaltic nature, there occur compact masses, 1—2 metres in diameter, composed of a mixture of sulphur, clay, coal-like substances, and vanadium sulphide. The colour of the fresh fracture is pale lead-grey, but the colour rapidly darkens when exposed to the air. An analysis gave:

SiO_2.	Fe.	Al.	V.	S.	CaO.	Carbon, &c.
22·22	1·08	8·32	15·36	41·81	0·33	10·88

This previously unknown naturally-occurring vanadium sulphide is called *Rizopatronite*; it has D 2·456, hardness 3·5, amorphous with a transitory metallic lustre, and is soluble in cold alkali and aqueous ammonia.
J. V. E.

The So-called Leesbergite. Willy Bruhns (*Mitt. Geol. Landesanst. Elsass-Lothringen*, 1908, **6**, 303—307).—This name has been given by Blum (*Ann. Soc. géol. Belgique*, 1907, **34**, *Bull.*, 118—120) to a white, chalky mineral from the Victor iron-mine, between Marspich and Hayingen, in Lorraine; from the analysis (I) he gave, the formula was deduced as $2MgCO_3,CaCO_3$. The material has much the appearance of hydromagnesite; in some parts it is harder and more compact, and in others, softer and looser in texture. In contact with water, the material soon falls to powder, but it does not absorb water as stated by Blum. Under the microscope, it is seen to consist of an aggregate of minute, strongly birefringent grains. Analyses II—IV are of different samples of material dried at 100°:

	CaO.	MgO.	CO_2.	H_2O.	Insol.	$Al_2O_3 + Fe_2O_3$.	Total.
I.	21·06	29·89	49·43	—	0·05	0·52	100·95
II.	16·06	32·81	42·82	[5·17]	3·14		100·00
III.	19·79	29·81	45·85	3·72	0·67		99·84
IV.	15·00	n. det.	46·44	3·19	trace		—

The material is thus not constant in composition, and is without doubt a mixture of a mineral allied to hydromagnesite,

$$[3MgCO_3,Mg(OH)_2,3H_2O],$$

with calcite or dolomite. L. J. S.

A Chemical Difference between Orthoclase and Microcline. PHILIPPE BARBIER (*Compt. rend.*, 1908, **146**, 1330—1332).—Twenty-five orthoclases and five microclines were decomposed by hydrofluoric and sulphuric acids, and the alkali chlorides examined spectroscopically. All the orthoclases contained small amounts of either lithium or rubidium, and sometimes both of these elements were present together, whilst in microcline they were absent. It is therefore considered that orthoclase and microcline are distinct species, and that they may be distinguished by this method. L. J. S.

[Celadonite from the Færöes.] JAMES CURRIE (*Trans. Edinburgh Geol. Soc.*, 1907, **9**, 1—68).—A detailed account is given of the topographical mineralogy of the Færöes. The following analysis, by T. F. Cowie, is given of celadonite from Stigafjall in the island of Strömö. The material lines amygdaloidal cavities in the basaltic rocks, being thicker at the bottom and colouring the associated heulandite up to a certain level in the cavities.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	H_2O.	Total.
52·39	20·82	5·09*	1·07	3·05	10·31†	5·72	98·45

* Including FeO. † Including Na_2O.

At 100° the loss of water is 3·34%, and the remainder is expelled at 180°. This analysis differs considerably, especially in the large content of alumina, from those of material from other localities, suggesting that celadonite or "green earth" is not a definite mineral species. L. J. S.

Japanese Zeolites. KOTORA JIMBŌ (*Beiträge zur Mineralogie von Japan*, 1907, No. 3, 115—120).—A description is given of analcite, apophyllite, heulandite, chabazite, and stilbite from Japanese localities Analysis I, by Tsukamoto, is of optically anomalous crystals of analcite from Maze. [The original paper makes no comment on the fact that this composition is most unusual for analcite; probably there is some error.] II is of large, pale green, optically anomalous crystals of apophyllite from Maze, where the mineral occurs with analcite, natrolite, and calcite in a basalt-agglomerate. III is of crystals of heulandite from Hatsuneura, in the island of Chichijima; and IV is of sheafs of stilbite from Obara.

	SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	F.	Loss on ignition.
I.	49·87	10·24	12·53	0·99	11·03	—	14·26
II.	50·18	1·33*	26·10	3·16	—	0·95	17·83
III.	60·58	15·67	6·25	0·12	1·51	—	15·98
IV.	54·00	17·94	7·94	1·12		—	19·37

* Including a little Fe_2O_3.

L. J. S.

Chlorophyllite from Vizézy. PHILLIPPE BARBIER (*Bull. Soc. chim.*, 1908, [iv], 3, 724—725).—A specimen of chlorophyllite from the Vizézy ravine, Montbrison, in the Loire valley, had the following composition:

SiO_2.	Al_2O_3.	FeO.	MnO.	MgO.	CaO.	K_2O.	Loss.	Total.
42·43	33·21	10·58	traces	2·61	traces	4·75	6·26	99·87

T. A. H.

A New Mineral Occurring with Tourmaline in Madagascar. ALFRED LACROIX (*Compt. rend.*, 1908, **146**, 1367—1371).—The pegmatite-veins intersecting crystalline limestones and mica-schists in the neighbourhood of Mt. Bity contain in their cavities crystals of smoky quartz, microcline, lepidolite, lithia tourmaline (often of gem quality and in very large crystals, which are often prominently zoned with different colours), beryl, and, in one instance, spodumene (colourless and the violet variety, kunzite). At Maharitra, the pegmatites contain a new mineral, which is decribed under the name *bityite*. It occurs as small, yellowish-white, hexagonal prisms, which are horizontally striated, and often aggregated in barrel-like shapes, in rosettes, or as a continuous crust over the other minerals. There is a perfect cleavage parallel to the basal plane. D 3·05, H 5½. Optically, the crystals are pseudo-hexagonal, showing a division into six sectors, each with a small angled negative bisectrix perpendicular to the basal plane. The refractive index is 1·62—1·64. Before the blowpipe, the mineral is readily fusible to an opaque, white, blebby glass; it is not attacked by acids. Analysis by F. Pisani gave:

SiO_2.	Al_2O_3.	CaO.	GlO.	MgO.	Li_2O.	Na_2O.	K_2O.	H_2O.	Total.
31·95	41·75	14·30	2·27	0·13	2·73	0·40	0·16	6·50	100·19

This gives the formula

$$10SiO_2,8Al_2O_3,5\tfrac{1}{2}(Ca,Gl,Mg)O,1\tfrac{1}{2}(Li,Na,K)_2O,7H_2O.$$

The water is expelled only at a very high temperature, and the formula may therefore be written as $5SiO_2,4Al_2O_3,7(R_2O+RO)$. The mineral may be classed as a basic orthosilicate in the staurolite and kornerupine group.

L. J. S.

Ilvaite from Shasta Co., California. BASIL PRESCOTT (*Amer. J. Sci.*, 1908, [iv], **26**, 14—16).—Massive and crystallised ilvaite occurs at Potter Creek, in Shasta Co., in connexion with ore-bodies of magnetite at a contact of limestone with diorite. The mineral is of contact-metamorphic origin, and is associated with hedenbergite. The crystals are bright, with a sub-metallic lustre and a greenish-brown streak. The following analysis by H. R. Moss agrees with the usual formula :

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Cr_2O_3.	H_2O.	Total.
28·09	0·32	20·80	29·93	3·24	15·89	0·18	0·13	1·62	100·20

L. J. S.

Amount of Dissolved Organic Carbon Compounds in the Sea, and their Significance in its Internal Economy. MARTIN HENZE (*Pflüger's Archiv*, 1908, **123**, 487—490 ; *Zeitsch. alg. Physiol.*, **7**, 283, 321 ; *Abh. K. Ges. Wiss. Göttingen. Math.-physiol. Klasse*, [2], **6**, 1).—Pütter has claimed that by the oxidation of the organic matter contained in sea-water, using Messinger's dichromate method, from 18 to 30 mg. of carbon dioxide per 100 c.c. can be obtained, and he stated that the organic matter to which this corresponds serves as nutrition for some of the lower organisms. The author has re-estimated the carbonic acid obtainable by the oxidation of organic matter in sea-water, using antimony for the absorption of the chlorine and other modifications of the Messinger method required in the case of sea-water. He only succeeded in obtaining from 0·4 to 3·5 mg. of carbon dioxide from 100 c.c., quantities which are within the limits of experimental error. He concludes, therefore, that Pütter's hypothesis entirely lacks experimental confirmation. S. B. S.

Physiological Chemistry.

Influence of Oxygen on Respiration. MARCUS S. PEMBREY and F. COOK (*Proc. physiol. Soc.*, 1908, xli—xlii; *J. Physiol.*, **37**).—If a person breathes air or oxygen in and out of a spirometer, the breaking point is chiefly determined by the amount of carbon dioxide present. But after exercise, it is easier to breathe oxygen than air in this way, and the breaking point occurs when the amount of carbon dioxide reaches a higher level. This is regarded as supporting the old view that the hyperpnœa of muscular exercise is due in part to products of metabolism other than carbon dioxide. W. D. H.

Effects of Excess of Carbon Dioxide and Want of Oxygen on the Respiration and Circulation. LEONARD HILL and MARTIN FLACK (*J. Physiol.*, 1908, **37**, 77—111).—Carbon dioxide at pressures from 15 to 30% causes hyperpnœa and convulsive breathing; above 30 to 35%, the excitatory effect is transient, and the narcotic effect produced may lead to respiratory arrest. Moderate doses raise the blood pressure and excite the vagus and vaso-motor centres. With higher concentrations, the blood pressure falls, owing to the depressant effect on the heart. Pure air and massage lead to recovery of the heart. On account of the excitatory effect of the gas, a mixture containing 5% of it should be employed in resuscitating cases of carbon monoxide and nitrite poisoning. The effect of want of oxygen is a dyspnœa much more gradual in onset, and terminating in a convulsive stage of great intensity. The blood pressure is usually, but not always, raised, and the vagus centre is excited, especially in the convulsive stage. The pressure then falls. The heart is not so rapidly depressed as in carbon dioxide poisoning.

The inability to hold the breath depends more on want of oxygen than on excess of carbon dioxide. The power to hold the breath is increased by breathing excess of oxygen. Breathing in and out of a small closed space extends the power to resist alterations in the gases, because the circulation is not mechanically impeded as it is when the breath is held. In muscular exercise, excess of carbon dioxide rather than want of oxygen excites hyperpnœa. Haldane and Priestley are right in stating that normal breathing is regulated by carbon dioxide tension in the alveoli, but in cases of obstructed aëration of the blood, diminished oxygen tension is the more potent agent. W. D. H.

The Residual Nitrogen of the Blood. HERMANN HOHLWEG and HANS MEYER (*Beitr. chem. Physiol. Path.*, 1908, **11**, 381—403).—The serum was coagulated in the presence of a mixture of equal parts of 1% acetic acid and 5% potassium phosphate solutions, so much of this mixture being added that the resulting liquid was distinctly acid to litmus, but neutral to Congo-red. Before coagulating this acidified mixture, it was diluted, and the diluted liquid half-saturated with sodium chloride. The blood was obtained from the femoral arteries of dogs. In one series of experiments, three samples of blood were withdrawn from each animal at three different periods, the first and last being withdrawn about seven hours after a meal, and the second during a period of starvation. In the second series of experiments, three samples were also withdrawn from each animal, the first and third during a period of starvation, and the second during the height of digestion. The total residual nitrogen was estimated in each sample, as well as that fraction which was precipitable with tannic acid; the urea was also estimated, the methods of Pflüger, Schöndorff, and Mörner-Sjögvist being employed. It was found, as a mean of all the experiments, that the total residual nitrogen of serum obtained during periods of starvation was 0·0525 gram per 100 c.c., whereas in the serum obtained during digestion it was 0·0788 gram; of these quantities, 0·0384 and 0·0567 gram were due to urea. The fraction precipitable with tannic acid showed no definite relationship to the state of nutrition. There was a small increase of the fraction not precipitable with tannic acid (exclusive of urea) in samples from the well-fed as compared with those from starving animals (0·0130 gram and 0·0060 gram respectively). The increase is too small for any definite conclusions to be drawn as to the circulation of the end products of digestion on the serum. Neither could any very definite increase of such products be detected in the serum after the addition of amino-acids and albumoses to the ordinary diet. S. B. S.

Gürber's Phenomenon. J. DUNIN-BORKOWSKI (*Bull. Acad. Sci. Cracow*, 1908, 318—325).—If red blood-corpuscles saturated with carbon dioxide are placed in a sodium chloride solution, and then removed, it is found that the liquid has become distinctly alkaline (Gürber's phenomenon).

The author has repeated these experiments, and has attempted to measure the concentration of hydroxyl ions by physico-chemical methods, but finds that the concentration is less when the globules have been saturated with carbon dioxide than in the absence of the dioxide. J. J. S.

The Action of Lipoid-soluble Substances on Red Blood-corpuscles. ISIDOR TRAUBE (*Biochem. Zeitsch.*, 1908, **10**, 371—379).—If the theory already advanced as to osmosis (this vol., ii, 565) is correct, solutions with the same surface tension, excepting acids and bases which exert a chemical action, should have the same hæmolytic capacity. Experiments were made to test this theory, and the results seem to confirm it.

Substances which at a certain concentration were found to act hæmolytically, acted anti-hæmolytically below that concentration.

S. B. S.

The Complex Hæmolysins. H. TSURASAKI (*Biochem. Zeitsch.*, 1908, **10**, 345—353).—Urea, the most important final product of metabolism, inhibits lipolysis, acting on the complement, but not on the amboceptor. Thiocarbamide and urethane also exert inhibitory action.

The conception of Sachs and Teruuchi that certain sera lose their hæmolytic capacity, owing to the presence of a ferment which destroys the complement at 37° and acts only in the diluted serum, was confirmed by some experiments on dogs' serum. After diluting the serum to 1 in 5, the complement was entirely destroyed by incubating for two hours at 37°. S. B. S.

Lipolysis, Agglutination, and Hæmolysis. IV. CARL NEUBERG (*Biochem. Zeitsch.*, 1908, **11**, 400—403).—An attempt was made to separate a substance producing lipolysis from one producing hæmolysis or agglutination, but without success. The experiments were carried out with ricin and with pancreatic juice. Red blood-corpuscles adsorb the agglutinin; after such treatment, however, the lipolytic function was also lost. Fibrin also adsorbs agglutinin, but a ricin solution treated with fibrin lost its lipolytic properties at the same rate at which it lost its agglutinating properties. Other adsorbents of agglutinins and hæmolysins, such as kaolin, lead to similar results. It seems probable from the experiments that the lipases play an important part in the phenomena of immunity. S. B. S.

Hæmolysis. SVANTE ARRHENIUS (*Biochem. Zeitsch.*, 1908, **11**, 161—171).—Hæmolysis by means of acids was investigated, and it was found that within certain limits there is a minimum action; both by increasing or diminishing the amount of acid above or below this limit, the hæmolysis is increased. This is due to protein coagulation, which within these limits inhibits the setting free of the hæmoglobin from the corpuscles.

From experiments carried out with suspensions of corpuscles of varying concentration (suspensions of 0·1% to 5%), it was found that the quantity of substance necessary to produce hæmolysis was a linear function of the corpuscle concentration. The corpuscles take up the hæmolysing substance, and hæmolysis follows when a certain relationship exists between the concentration of this substance in the envelopes and that in the surrounding fluid. An equation can be found by means of which the relative quantities of various hæmolysins taken up by the envelopes can be ascertained from experimental data.

Lecithin was found to increase the hæmolytic action of acids, especially if allowed to remain in contact with the corpuscles before the acid was added. It has no action on the hæmolytic power of alkalis, and inhibits that of saponin. Alcohols and ether increase the hæmolytic action of cobra poison, and diminish that of saponin. Sodium oleate increases also the action of cobra poison, diminishing that of saponin. Calcium chloride diminishes the action of the sodium oleate on the cobra poison, this being due, as the author points out, to the formation of an insoluble salt. It is assumed that the lecithin action of acids is due, on the other hand, to increased solubility.

S. B. S.

The Mechanism of Hæmolysis by Saponin. Kurt Meyer (*Beitr. chem. Physiol. Path.*, 1908, **11**, 357—364).—The hæmolytic action of saponin (Merck) on different species of blood-corpuscles was investigated. It was found that those corpuscles containing the largest amount of cholesterol were most resistant to the hæmolytic action.

S. B. S.

Effect of Diet on the Amylolytic Power of Saliva. C. Hugh Neilson and D. H. Lewis (*J. Biol. Chem.*, 1908, **4**, 501—506).—Previous results on the influence of diet on animals' saliva are contradictory. The present experiments were performed on human saliva. The amylolytic power rises with carbohydrate, and falls with protein, diet.

W. D. H.

Assimilation of Protein Introduced Parenterally. Wilhelm Cramer. **Assimilation of Protein Introduced Enterally.** Harold Pringle and Wilhelm Cramer (*J. Physiol.*, 1908, **37**, 146—157, 158—164).—Evidence is adduced that egg-white introduced parenterally is partly assimilated and partly eliminated in the urine. The portion which is assimilated is believed to be taken up by the leucocytes. During ordinary absorption from the intestine, the leucocytes are also considered to play an important part. The intestinal mucous membrane is richer in non-coagulable nitrogen than during a fast, and this increase is most marked in the lymphoid nodules of the intestine. The blood of digesting animals shows a small, but distinct, increase in residual nitrogen over that of fasting animals, and part of this is ascribed to the corpuscular elements.

W. D. H.

Influence on Internal Hæmorrhage on Protein Metabolism. FRED S. WEINGARTEN and BURRILL B. CROHN (*Amer. J. Physiol.*, 1908, **22**, 207—244).—Internal hæmorrhage was imitated in dogs by transferring blood to the extent of 2·8 to 3·5 of the body weight from the femoral artery into the abdominal cavity. There was a slight rise of the specific gravity of the urine on the days when this was done, and a very slight rise in the excretion of nitrogen, sulphur, and phosphorus. Many other points in metabolism, secretion, composition of urine, &c., were investigated, but with wholly negative results.

W. D. H.

The Occurrence of Urocanic Acid in a Pancreatic Digest. ANDREW HUNTER (*Proc. physiol. Soc.*, 1908, xxxvii—xxxviii; *J. Physiol.*, **37**).—From a long-continued pancreatic digest of plasmon, a substance having the elementary composition and other properties of Jaffe's urocanic acid ($C_{12}H_{12}O_4N_4$) was isolated. W. D. H.

Relative Rate of Absorption of Optically Isomeric Substances from the Intestine. HENRY D. DAKIN (*J. Biol. Chem.*, 1908, **4**, 437—438).—It is well known that isomerides differing in optical action are assimilated to varying degrees by the animal organism. The present experiments performed on intestinal loops with the optically differing lactic acids and other substances gave no evidence of any selection during the preliminary process of absorption.

W. D. H.

Theory of Chemical Energy in the Living Cell. OSCAR LOEW (*Centr. Bakt. Par.*, 1908, ii, **21**, 198—200).—Polemical against Bredig (Abstr., 1907, ii, 943). G. B.

The Difference between Isosmotic and Isotonic Solutions in Artificial Parthenogenesis. JACQUES LOEB (*Biochem. Zeitsch.*, 1908, **11**, 144—160).—The first question considered is how a hypertonic solution brings about parthenogenesis. The solution is not so much an exciting as a correcting agent. The excitant is the formation of an artificial membrane of lipoid nature (principally lecithin) at the periphery of the egg. The second question dealt with is that isosmotic solutions for the egg are in general not isotonic.

W. D. H.

The Glycogenic Changes in the Placenta and the Fœtus of the Pregnant Rabbit; a Contribution to the Chemistry of Growth. J. LOCHHEAD and WILHELM CRAMER (*Proc. Roy. Soc.*, 1908, **80**, *B*, 263—284).—Analyses were made of the glycogen in the maternal and fœtal placenta of rabbits, as well as in the fœtal liver and the remaining part of the fœtal bodies, which were removed from pregnant animals in different stages of gestation from the fourteenth day onwards. The placenta was mechanically separated into maternal and fœtal parts, and the glycogen in each of these parts was estimated separately. The greater part of the placental glycogen was found in the maternal placenta. It was found that the percentage of this glycogen diminished from the eighteenth day onwards, whereas that in the fœtal liver increased. It was also found that there is a distinct parallelism between the growth of the fœtus and the amount of glycogen which it contains. The conclusion was drawn that the placenta of the rabbit has the function of depositing glycogen as a store of carbohydrate for the needs of the fœtus. The investigation of the distribution of the glycogen-splitting enzyme led to the conclusion that the glycogen is absorbed from the maternal placenta in the form of a simpler carbohydrate, the transformation of the glycogen taking place in the placenta by the action of a secreted enzyme. In the earlier stages of intra-uterine life, the liver of the fœtus does not appear to possess the power of storing glycogen; the power is not acquired until the last week of gestation. In the earlier stages of uterine life, therefore, the placenta fulfils the hepatic functions so far as glycogen is concerned. Investigations were also undertaken on the effect of variations of diet and of phloridzin injection, and it was considered from the results obtained that the glycogen metabolism of the placenta and fœtus is independent of that by the mother, and is governed by conditions in many respects different from those which regulate the metabolism of the adult animal. The glycogenic metabolism of the rabbit is different from that of the sheep and cow. S. B. S.

Temperature-coefficient of Rate of Conduction in Nerve. Keith Lucas. **Temperature-coefficient of Rate of Conduction and Latent Period in Muscle.** W. J. Woolley (*J. Physiol.*, 1908, 37, 112—121, 122—129).—Maxwell found the temperature-coefficient for conduction in molluscan nerve to be 1·78. The present figures for amphibian nerve give a mean of 1·79. Conduction in amphibian muscle gives a coefficient of 1·79 to 2·01. The conductive process is therefore probably similar in both tissues, but doubt is expressed whether the high coefficient is a necessary proof of a chemical as opposed to a physical process. The coefficient for the latent period of muscle is 3·26 to 3·3; this strengthens the supposition that conduction in muscle is a propagation, not of the contractile change, but of an independent disturbance, which calls up the contractile change at each point on its passage. W. D. H.

Action of Nitrites and Atropine on Autonomic Nerves. Alfred Fröhlich and Otto Loewi (*Arch. exp. Path. Pharm.*, 1908, 59, 34—56).—Certain autonomic nerves can be differentiated from those of sympathetic origin by their behaviour towards drugs, as shown in the following table:

Nerves.	Accelerator.		Inhibitory.	
	Stimulated by	Paralysed by	Stimulated by	Paralysed by
1. Autonomic......	Pilocarpine	Atropine		Nitrites.
2. Sympathetic....	Adrenaline	Ergotoxin	Adrenaline	

These facts point to chemical differences in the nerve terminals.
W. D. H.

The Permeability of the Frog's Skin. William M. Bayliss (*Biochem. Zeitsch.*, 1908, **11**, 226—237).—The physical examination of the frog's skin in the living condition shows that its properties are not so clearly defined as those of the homogeneous membrane of the red corpuscles (Hamburger) or of muscle fibres (Overton). Its properties are only partly explicable on the hypothesis that it is a semipermeable membrane. Its most interesting property is its irreciprocal permeability to sodium ions. W. D. H.

A New Function of the Pancreas and its Relation to Diabetes melitus. Otto Loewi (*Arch. exp. Path. Pharm.*, 1908, **59**, 83—94).—In normal men, cats, and dogs, adrenaline does not produce dilatation of the pupil, but this does take place in the following circumstances: (1) After total extirpation of the pancreas in dogs and cats; (2) in pancreatic insufficiency artificially produced in animals; (3) in many cases of human diabetes presumably of pancreatic origin; (4) in many cases of Basedow's disease.

It therefore appears that the pancreas has the power of inhibiting the sensitiveness to adrenaline in certain organs supplied by sympathetic nerves. In the last of the four cases, the susceptibility to adrenaline is possibly produced by hyperthyreodism. W. D. H.

Contraction of Striated Muscle. John S. Macdonald (*Proc. physiol. Soc.*, 1908, xxv—xxvii; *J. Physiol.*, **37**).—An attempt to explain the contraction of muscle by supposing that electrolytes make their appearance in the dark bands which raise the osmotic pressure there, and so water is attracted from the light bands. This is supported to some extent by changes in the distribution of the potassium salts as determined by Macallum's reagent, but the process of relaxation is admittedly left unexplained. W. D. H.

Non-striated Mammalian Muscle. Tadasu Saiki (*J. Biol. Chem.*, 1908, **4**, 483—496).—The non-striated muscle of the stomach and bladder is richer in water than striated muscle, and contains 2·8% to 3% of nitrogen. Traces of glycogen are present, and only 0·05% of lactic acid, although no precautions to avoid injury were taken. The creatine percentage is also low (0·8%); so is that of creatinine (0·024% to 0·052%). Hypoxanthine is the most abundant purine base; minute amounts of guanine and adenine are occasionally obtained, but never xanthine. The amount of hæmoglobin is 0·13% to 0·3%, which is less than in blood-free striated muscle (1% to 2·3%). The amount of connective tissue is greater than in striated muscle. Sodium, iron, calcium, and chlorine are more abundant than in striated muscle; the opposite is true for other elements, potassium, magnesium, &c. There is about three times as much sodium as potassium. The influence of such ions on the manner of contraction is discussed. As much, or almost as much, of the soluble proteins were obtained twenty-four hours after removal in muscles kept at room temperature as in those kept in ice. No evidence of rigor mortis is therefore forthcoming. In spite of the low percentage of glycogen, evidence was obtained of its disappearance. W. D. H.

Muscle Plasma. JOHN MELLANBY (*Proc. physiol. Soc.*, 1908, xxxiv—xxxv; *J. Physiol.*, **37**).—Muscle plasma, prepared from bird's muscle, and containing 3% of added sodium chloride, clots on the addition of a little acid. This is prevented by dilution with water, but occurs immediately when more salt is added. It is soluble in excess of acid, but this is prevented by adding more salt. The coagulum produced by acid, when thoroughly washed, forms a gelatinous solution in water, which is acid to litmus, and is reprecipitated by small amounts of neutral salts. After careful precipitation of acid, the muscle plasma is practically free from protein.

Wide-reaching conclusions are drawn from these few experiments with salted muscle plasma to explain the coagulation of natural muscle plasma in rigor mortis. The combined action of salt and lactic acid is considered to cause rigor, and the development of more acid to produce its disappearance. The observations are also stated to indicate that there is only one protein in muscle, but in this preliminary communication no evidence is offered on this point.

W. D. H.

The Utilisation of Sugar during Muscular Activity. JOHANNES MÜLLER (*Chem. Zentr.*, 1908, i, 1567; from *Zentr. Physiol.*, 1908, **21**, 831—833).—The author has succeeded in isolating lactic acid from the perfusion liquid by means of the zinc salt. In spite of a sufficient oxygen supply, the amount of acid isolated corresponded with the amount of sugar utilised. S. B. S.

Mono-amino-acids in Meat Extract. KARL MICKO (*Zeitsch. physiol. Chem.*, 1908, **56**, 180—211).—Meat extracts contain a small and unimportant percentage of mono-amino-acids (alanine 0·23, glutamic acid 0·08, taurine 0·2%); there is also 0·36% of inosite. Dipeptides were not found. W. D. H.

A Phytin-splitting Enzyme in Animal Tissues. ELMER V. McCOLLUM and EDWIN B. HART (*J. Biol. Chem.*, 1908, **4**, 497—500). —Liver and blood contain a phytase, but not muscle and kidney.

W. D. H.

Influence of Inorganic Colloids on Autolysis. IV. M. ASCOLI and G. IZAR (*Biochem. Zeitsch.*, 1908, **10**, 356—370. Compare this vol., ii, 121).—There is in the main an agreement between the action of colloidal silver on metabolism and on autolysis. Minimum amounts favour uric acid production. The uric acid-forming ferments are activated by colloidal silver, ferrous hydroxide, and arsenic sulphide. Larger amounts of the two last named inhibit uric acid formation. Uricolysis is delayed by colloidal silver; the other two colloids have no action on this phenomenon.

W. D. H

The Autolytic and Hydrolytic Degradation of Protein under Normal and Pathological Conditions. W. Glikin and Adolf Loewy (*Biochem. Zeitsch.*, 1908, **10**, 498—505).—The tissues were allowed to autolyse for several days in toluene water until the action practically ceased. The ammonia-nitrogen, monoamino-acid-nitrogen, and diamino-acid-nitrogen, both in the dissolved part and undissolved part of the tissue, were then determined. The same factors were also determined for a portion of the same tissues which had been directly hydrolysed without previous autolysis. Normal organs were examined (liver and muscular tissue), as well as those from animals which had been poisoned by hydrochloric and hydrocyanic acids. The autolysis of muscular tissue from animals poisoned by acids appears to be somewhat below the normal. The results, however, do not permit of any very definite conclusions being drawn. S. B. S.

Available Alkali in the Ash of Human and Cows' Milk. Joseph H. Kastle (*Amer. J. Physiol.*, 1908, **22**, 284—308).—Although the amount of ash in human milk is much less than in that of cows' milk, the amount of alkali as detected by phenolphthalein, and available for nutritive purposes, is the same. Numerous analyses are given, and various subjects in relation to milk in infant feeding are discussed at length. Among the points raised, the view is acquiesced in that much of the indigestibility of cows' milk in children is due, not so much to its protein constituents, as to excess of fat. W. D. H.

Milk-serum. Fr. Landolf (*Biochem. Zeitsch.*, 1908, **10**, 486—489).—Fractional examination of the osazones obtained from the serum of cows' milk leads to the conclusion, not that several modifications of lactose are present, but that lactose is united in part to other carbohydrates, and this factor modifies the polarisation, reduction power, fermentation, and the properties of the osazones. W. D. H.

The Ferment which Destroys Lactose in Milk. Albert J. J. Vandevelde (*Biochem. Zeitsch.*, 1908, **11**, 61—66).—Lactose is gradually destroyed in cow's milk when the latter has not been boiled. The reaction only takes place to a very slight extent in the presence of formaldehyde, but considerable change takes place when the milk is kept sterile by means of iodoacetone. Reducing compounds are formed which have not yet been isolated. S. B. S.

The Excretion of Sulphurous Acid on the Human Subject after Administration of Sodium Sulphite and Sulphurous Acid in Combination with Sodium Salt. Fr. Franz and G. Sonntag (*Chem. Zentr.*, 1908, i, 1477—1478; from *Arb. K. Gesundh.-Amt.*, 1908, **28**, 225—260).—Experiments were made to determine the form of excretion of sulphurous acid after administration of neutral sodium sulphite and formaldehyde, acetaldehyde, and dextrose sodium sulphites. Under certain conditions, sulphurous acid was obtained from the urine. This acid can be estimated by oxidation to sulphuric acid by hydrogen peroxide. Care, however, must be taken in drawing conclusions as to the presence of sulphites in urine, as the latter on distillation yields sulphur compounds of unknown nature. In men, as in dogs, by far the greatest part of the injected sulphite is oxidised to sulphate. In certain cases, after intervals of ten minutes or a quarter of an hour, sulphites can be detected in the urine. The quantity was, however, never more than 1% of the sulphite administered. S. B. S.

New Organo-mercury Compounds. "Iodoargyrum." GIULIO NARDELLI (*Chem. Zentr.*, 1908, i, 1572; from *Arch. Farm. Sperim.*, 1908, **7**, 69—83).—The author finds that the mercury of this compound, $C_4H_4SHg_4I_4$ (Paolini, Abstr., 1907, i, 788), is passed in the urine in larger quantities than in the fæces. Taken in small doses, the iodine is passed in twenty-four hours, and the third constituent, thiophen, could not be detected in the urine; it appears to become changed in the system. J. V. E.

Estimation of Reducing Substances in Infants' Urine. ROBERTO FUNARO (*Biochem. Zeitsch.*, 1908, **10**, 463—466).—The total reduction in normal urine was estimated by Bang's method, the sugar by Bang's method, the uric acid by the Hopkins-Folin method, and the creatinine by Folin's method. After deducting the reduction due to sugar, uric acid, and creatinine, the remainder is due to *iso*maltose, dextrin, glycuronic acid, and unknown substances. Tables of analyses are given, and Lavesson's conclusion is confirmed that infants' urine contains a smaller amount of all these substances than the urine of adult men and women. W. D. H.

Amino-acids in the Urine during Pregnancy. E. C. VAN LEERSUM (*Biochem. Zeitsch.*, 1908, **11**, 121—136).—The main difficulty in Pfaundler's method of estimating the amino-acids in urine is the removal of the phosphotungstic salts. They can, however, be entirely removed by the addition of potassium chloride without any loss in the amino-acids taking place. The amino-acid nitrogen varies in health from 2·7 to 7·7% of the total nitrogen. It is increased by administering amino-acids. In pregnant women, it rises to over 10% in 40% of the cases, and the highest point is usually reached just before parturition; in some cases, it occurs after delivery; this may be related to the process of uterine involution. W. D. H.

Origin of Endogenous Uric Acid. E. PROVAN CATHCART, E. L. KENNAWAY, and JOHN B. LEATHES (*Quart. J. Med.*, 1908, **1**, 416—446).—A marked increase in the output of endogenous uric acid is found to occur in three conditions: (*a*) fever: here the increased output coincides and terminates with the rise of temperature. (*b*) Exposure to cold. (*c*) After severe exertion. In the last two cases the increased output outlasts its cause by many hours.

The high output in the morning is not due to retention of uric acid formed during the night (as Hirschstein considers), or to inactivity of the digestive organs in the night (and it is doubtful if such inactivity really occurs), but to the quickened activity of all functions, especially of voluntary muscles, which occurs after rest. The more lively the performance of the bodily functions the greater does the output of uric acid tend to be, and it is suggested that uric acid has its origin principally in the metabolic processes of the voluntary muscles. W. D. H.

Creatinine of Infants' Urine. Roberto Funaro (*Biochem. Zeitsch.*, 1908, **10**, 467—471).—Creatinine is always present in infants' urine. The individual differences are not great, even if the diet varies. The small amount present explains why those who used the zinc chloride method have been unable to detect it.

W. D. H.

Excretion of Pigments by the Urine. Rudolf Höber and Felicja Kempner (*Biochem. Zeitsch.*, 1908, **11**, 105—120).—If pigments insoluble in lipoids were injected intravenously in frogs, they were in part taken up by the kidney cells and excreted. Such pigments are acid magenta, aniline-blue, Congo-red, and many others. Other pigments were not taken up, such as Berlin-blue, benzoazurin, &c. The difference partly depends on how far the pigments are in colloidal solution; those which are not taken up being highly colloidal, but there are exceptions to this rule, for instance, Congo-red.

W. D. H.

Urinary Constituents Precipitable by Phenylhydrazine. Hugo Milrath (*Zeitsch. physiol. Chem.*, 1908, **56**, 126—134).—If dogs' urine is warmed for two hours on the water-bath with phenylhydrazine and acetic acid, phenylsemicarbazide is not obtained. Four to five hours' heating is necessary for the purpose, although cats' urine will sometimes yield the product in two hours. In the case of human urine, two to five hours is necessary, and in ten hours 80% of the urea is converted into phenylsemicarbazide. Aqueous solutions of urea yield similar results. W. D. H.

Arnold's Urinary Reaction with Sodium Nitroprusside. Theophil Holobut (*Zeitsch. physiol. Chem.*, 1908, **56**, 117—125).—In people taking a meat diet, the urine gives a violet reaction with sodium nitroprusside and sodium hydroxide; this soon changes to purple, and finally yellow. If ammonia is used instead of sodium hydroxide, the colour lasts longer. The same coloration is obtained with dogs' urine when the animals are fed on cooked meat, cheese, eggs, and other protein-rich food, but not when they are fed on raw flesh, gelatin, or vegetable albumin. W. D. H.

Molecular Concentration of Pathological Fluids. Adolphe Javal (*Compt. rend.*, 1908, **146**, 1328—1330).—Hypoconcentration is relatively rare; hyperconcentration is fairly frequent in disease, especially in cases of cardiorenal insufficiency. This is mainly due to salts, and estimations of the amount of sodium chloride in different fluids of the body are given. The increase of concentration is increased in some cases by the retention of nitrogenous catabolites.

W. D. H.

The Chemical Test for Diseases due to Nerve Degeneration. The Formation of Alkylamines. Koloman Bauer (*Beitr. chem. Physiol. Path.*, 1908, 11, 502—514).—Concentrated urine was, after certain preliminary treatment, made alkaline, and the bases distilled over with steam into acid. The solution of the salts thus obtained was evaporated down and the residue treated with sodium hypobromite, whereby ammonia and primary and secondary bases were destroyed. The tertiary base trimethylamine was then distilled over with steam and isolated in the form of its platinichloride.

It was found that trimethylamine was a constant constituent of normal urine, due to the normal degradation of lecithin substances. Substances containing a choline complex, such as eggs and meat, added to the diet, caused an increase in trimethylamine elimination. The normal output of trimethylamine with a mixed diet is 18 to 26 mg. per day for an adult man. The base was also estimated in several cases of nervous disease. The average quantities found were: 51 mg. daily in the cases of tabes, 59 mg. in myelitis, and 37 mg. in progressive paralysis. In one case of neurasthenia, the amount of trimethylamine found gave no evidence of destruction of nervous matter, whereas in a second case it did. S. B. S.

Protein Metabolism in Cystinuria. Charles G. L. Wolf, Philip A. Shaffer [with Emil Osterberg and Michael Somogyi] (*J. Biol. Chem.*, 1908, 4, 439—472).—The anomalies of metabolism in cystinuria consist in low ammonia, high undetermined nitrogen, and high neutral sulphur in the urine. The high undetermined nitrogen is partly, and the high neutral sulphur wholly, due to cystine. The ingestion of protein in a cystinuric person increases the neutral sulphur, and so presumably increases the cystine in the urine. If cystine or cysteine is given by the mouth, they are completely broken down to sulphates; it must, therefore, be assumed that the cystine group of the protein is not absorbed as such, but in combination as polypeptide or thioproteose. These appear to be different types of cystinuria, but it is only in the more severe cases that tolerance for cystine or other amino-acids is diminished. If cystine is given subcutaneously, it is partly oxidised and partly excreted in the urine, but no controls were made on healthy people. Sulphur-free amino-acids are almost quantitatively catabolised to urea. Sodium cholate does not increase the cystine excreted. With regard to the time relations of the excretion after protein-feeding, no standards of comparison in normal persons are at present available. In the cystinuric patients, the maximum of nitrogen excretion occurred later than that of carbon, and the former was coincident with that of sulphur. The maximum excretion of ammonia was early. The curves for neutral sulphur and undetermined nitrogen were approximately parallel. The relationships of cystinuria to bile secretion are discussed, but without any very clear conclusions. In cases of cystinuria in which the excretion of cystine stops from time to time, the sulphur of the urine returns to normal for these periods, but the undetermined nitrogen remains high on many days; this is possibly due to amino-acids. W. D. H.

Carbon Dioxide in Venous Blood and Alveolar Air in Cases of Diabetes. ARTHUR P. BEDDARD, MARCUS S. PEMBREY, and EDMUND I. SPRIGGS (*Proc. physiol. Soc.*, 1908, xxxix—xli; *J. Physiol.*, **37**).—The results and figures given appear to show that with a prolonged and increasing acidosis in severe diabetes, a point is reached in which increased ventilation of the lungs occurs, which leads to a decrease of the carbon dioxide in the alveolar air and blood, notwithstanding that the blood is still capable, in spite of its reduced alkalinity, of taking up large quantities of carbon dioxide. The increased respiration is ascribed to the stimulation of the respiratory centre by acid substances, including carbon dioxide and other acids produced by metabolism, and prolonged acidosis appears to increase the sensitiveness of the centre. W. D. H.

Influence of Diuretics on Phloridzin Diabetes. OTTO LOEWI and E. NEUBAUER (*Arch. exp. Path. Pharm.*, 1908, **59**, 57—63).—In contrast with other diuretics, the addition of sodium chloride does not increase the diuretic action of phloridzin, neither is the amount of sugar excreted increased by the administration of diuretics.

W. D. H.

Influence of Calcium on Diuresis. OTTO PORGES and EGON PŘIBRAM (*Arch. exp. Path. Pharm.*, 1908, **59**, 30—33).—If calcium chloride is introduced into the blood stream, its diuretic action is about equal to that of sodium chloride, unless doses sufficiently large to lower the blood pressure are given. W. D. H.

Physico-chemical Considerations as to the Pharmacological and Toxicological Actions of Mercury. LUIGI SABBATINI (*Biochem. Zeitsch.*, 1908, **11**, 294—310).—The toxic effects of mercury on higher animals, just as in the case of bacteria, as shown by Krönig and Paul, depend on the concentration of mercury ions. Thus, by intravenous injection of sodium chloride, bromide, or iodide before the mercuric chloride, the toxic effect of the latter is depressed, owing to its decreased dissociation due to the presence of the sodium salts. The iodide is more effective than the bromide, and the bromide than the chloride, the iodide and bromide of mercury both dissociating less than the chloride. The lesions due to mercury poisoning can also be explained by the concentration of the mercury ions. These lesions occur chiefly in the secretory and excretory tracts. The concentration of the ions in the saliva, for example, would be great, owing to the absence of chlorides and proteins. In the stomach, on the other hand, the presence of chlorides and of protein would depress the dissociation of the chlorides; here the disturbance in mercury poisoning would be small. In the small intestine, the chlorides and peptones are still in large quantity, and again the dissociation would be small. Still lower in the intestinal tract, owing to absorption of chlorides and products of tryptic digestion, the dissociation of mercury salts would be greater, and therefore the toxic effects can be observed. The lesions in the kidneys themselves, due to mercuric poisoning, occur almost exclusively in the convoluted tubules. Here, according to the Ludwig hypothesis, the urine is dilute, and becomes gradually concentrated in the passages, and here, also, the dissociation of the mercury salt and concentration of the ions can be great: hence the lesions. S. B. S.

The Degradation of Carboxylic Acids in the Animal Body. VII. The Formation of Acetoacetic Acid from *iso*Valeric Acid by Perfusion through the Liver. Ernst Friedmann (*Beitr. chem. Physiol. Path.*, 1908, 11, 365—470. Compare this vol., i, 421; ii, 205).—Embden has shown that *iso*valeric acid is converted into acetoacetic acid by perfusion through the surviving liver:

$$CHMe_2\cdot CH_2\cdot CO_2H \longrightarrow CH_3\cdot CO\cdot CH_2\cdot CO_2H.$$

To determine the mechanism of the reaction, perfusion experiments were carried out with the following acids. *iso*Valeric acid, α-hydroxy*iso*valeric acid, β-hydroxy*iso*valeric acid, pyrotartaric acid, and citramalic acid. Of these, only *iso*valeric acid and the β-hydroxy-derivative lead to the formation of acetone (and acetoacetic acid). From these results, the conclusion is drawn that the secondary carbon atom offers the first point of attack, and that the methyl group is not first oxidised.

S. B. S.

The Degradation of Carboxylic Acids in the Animal Body. VIII. The Behaviour of αβ-Unsaturated Acids when Perfused through the Liver. Ernst Friedmann (*Beitr. chem. Physiol. Path.*, 1908, 11, 371—375).—Both dimethylacrylic and crotonic acids give rise to acetone by perfusion through the liver, whereas citraconic and mesaconic acids do not. The methyl group here does not offer the first point of attack, but the chemical change can be best explained by assuming that the addition of the elements of water at the double linking first takes place with the formation of β-hydroxy-acids. Dimethylacrylic acid, according to this hypothesis, would be converted into β-hydroxy*iso*valeric acid, which readily gives rise to acetone (compare preceding abstract).

S. B. S.

Degradation of Carboxylic Acids in the Animal Body. Henry D. Dakin (*Beitr. chem. Physiol. Path.*, 1908, 11, 404—405).—Friedmann has claimed (see this vol., ii, 205, and also preceding abstracts) that, on degradation of carboxylic acids, oxidation takes place first at the β-carbon atom with the formation of β-hydroxy-compounds. To this Knoop has objected, claiming that in normal fatty acids, oxidation generally takes place at the α-position, and that the formation of β-hydroxy-derivatives is an indirect process. Dakin, in support of Friedmann, shows, however, that *n*-butyric acid can yield acetone to the extent of 50% of the theoretical quantity when oxidised by hydrogen peroxide. This reaction can be best explained on the assumption that a β-hydroxy-derivative is first formed. Furthermore, all other fatty acids of the same series, up to stearic acid, undergo a similar oxidation. Octoic acid yields methyl *n*-amyl ketone; lauric acid, methyl *n*-nonyl ketone, and stearic acid, methyl *n*-pentadecyl ketone. The reactions may be represented as follows:

$$R\cdot CH_2\cdot CH_2\cdot CO_2H \longrightarrow R\cdot CH(OH)\cdot CH_2\cdot CO_2H \longrightarrow R\cdot CO\cdot CH_2\cdot CO_2H \longrightarrow R\cdot CO\cdot CH_3.$$

Further, phenylpropionic acid, when administered to an animal, yields, in addition to hippuric acid, β-hydroxyphenylpropionic acid and acetophenone, another example of β-oxidation. The reaction also takes place *in vitro* when hydrogen peroxide is employed as the oxidising reagent (see below). S. B. S.

The Oxidation of Fatty Acids. Franz Knoop (*Beitr. chem. Physiol. Path.*, 1908, **11**, 411—414).—Reply to Friedmann on question of "β-oxidation" (see preceding abstracts of Friedmann and Dakin). S. B. S.

Oxidation of Phenyl Derivatives of Fatty Acids by the Animal Organism and by Hydrogen Peroxide. Henry D. Dakin (*J. Biol. Chem.*, 1908, **4**, 419—435).—After hypodermic injection, β-phenylpropionic acid is broken down in dogs to

$$OH\cdot CHPh\cdot CH_2\cdot CO_2H,$$

$COPh\cdot CH_2\cdot CO_2H$, $COPhMe$, and $PhCO_2H$, the last substance occurring in the urine as hippuric acid. β-Hydroxy-β-phenylpropionic acid occurs as the lævorotatory variety, in close analogy to *l*-β-hydroxybutyric acid. Benzoylacetic acid could not be isolated, but its production is inferred from the occurrence of acetophenone in the urine.

The oxidation of β-phenylpropionic acid and of β-hydroxy-β-phenylpropionic acid by hydrogen peroxide is very similar, acetophenone and benzoic acid being produced; the oxidation proceeds slowly even at 37°.

In order to test the hypothesis that phenylacetic acid owes its resistance to oxidation to its combination with glycine, β-*phenylpropionylglycine*, $CH_2Ph\cdot CH_2\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$ (thick needles, m. p. 114—115°, more soluble in water than hippuric acid) was synthesised. After administration to dogs, it yields, however, the same degradation products as phenylpropionic acid. G. B.

[Physiological] Action of Optical Isomerides. III. Adrenaline. Arthur R. Cushny (*J. Physiol.*, 1908, **37**, 130—138).—Neutral or *l*-adrenaline acts twice as strongly on the blood pressure as synthetic or *r*-adrenaline, and presumably also on the other organs affected by adrenaline. From this it is inferred that *d*-adrenaline is devoid of action on these tissues, and this was confirmed by the examination of a partly isolated *d*-adrenaline.

W. D. H.

Action of the Digitalis Group on the Kidneys. D. Jonescu and Otto Loewi (*Arch. exp. Path. Pharm.*, 1908, **59**, 71—82).—Substances of the digitalis group act as diuretics in doses insufficient to raise the blood pressure. They act by dilating the renal bloodvessels, and this is a specific effect on these vessels. W. D. H.

The Action of Strychnine on the Nerve Fibres of the Vagus to the Heart. V. Forli (*Chem. Zentr.*, 1908, i, 1568; from *Zentr. Physiol.*, 1908, **21**, 823—827).—Strychnine sulphate solution was allowed to act on the nerve fibres of the vagus of the heart in a cat; a diminution of conductivity and irritability of the affected position was observed, analogous to the action of the same substance on the sympathetic nerve fibres in the neck. S. B. S.

Sulphurous Acid in its Biochemical Relationship. Leo Grünhut (*Biochem. Zeitsch.*, 1908, **11**, 89—104).—Theoretical considerations are advanced as to the reason of the comparative toxicity of various solutions of sulphites, and compounds with salts of sulphites. The conclusion is drawn that the specific toxicity of a given sulphite solution depends on the quantity of $[H_2SO_3]+[SO_2]$ contained therein. S. B. S.

Chemistry of Phosphorus Poisoning. Otto Porges and Egon Přibram (*Arch. exp. Path. Pharm.*, 1908, **59**, 20—29).—In the phosphorus liver, a smaller part of the nitrogen is in the form of protein than in the normal liver. The lessening of hexone bases is still more marked. On autolysis, the nitrogen contained in substances precipitable by tannin is much greater than in autolysis of the normal liver. The nitrogen split off by hydrochloric acid is raised from 10% (the normal number) to 13%. How far these changes are due to differences in ferment action is discussed. W. D. H.

The Supposed Antidotes to Alkaloids and Artificial Antitoxins. H. Dorlencourt (*Chem. Zentr.*, 1908, i, 1568; from *Bull. Sci. Pharm.*, 1908, **15**, 82—88).—The statement of Baudran that antitoxins to alkaloids can be prepared by treating the latter with calcium permanganate was submitted to experimental investigation. It was found that a lethal dose of strychnine, injected intra-muscularly together with the substance produced by the action of calcium permanganate on the alkaloid, produced no toxic action. Heating the mixture to 120° produced no change in its action, and it was found that manganese salts, such as the chloride, act as an antidote to strychnine. There is, therefore, no question of a specific antitoxin. Similar results were obtained by intra-cerebralar as by intra-muscular injections, and it is suggested that manganese salts might be employed as antidotes in therapeutic practice. S. B. S.

Cobra Poisoning and Hæmolysis. Ivar Bang (*Biochem. Zeitsch.*, 1908, **11**, 520—537).—The importance of lecithin in cobra poisoning, as advanced by Kyes and others, is denied, and the existence of cobra-lecithids considered unproved. Kyes' cobra-lecithid is not a pure substance; it may be a mixture of poison and activator, or a chemical combination, but it is quite uncertain what the activator is; the mixture contains decomposition products of phosphatides, fats, and soaps. Lecithin itself, prepared from egg-yolk, was found to be wholly inactive as an activator to cobra venom in producing hæmolysis; the same is true for the monoaminophosphatide, cuorine, and the diaminophosphatide of egg-yolk. The kephalin fraction was found to be active, but the exact composition of this fraction is uncertain. Kossel's protagon, which consists largely of kephalin, is, however, inactive. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

The Action of the Zinc Ion on Media for Microbes. JOSEPH MENDEL (*Compt. rend.*, 1908, **146**, 1290—1291).—Two electrodes, one of zinc and the other of platinum, were introduced into an infected gelatin tube, and a current of 1—5 milliamperes was passed through the medium for some minutes. An opaque zone developed round the zinc electrode, and the bacteria with which the medium had been infected grew well everywhere, except within this zone. S. B. S.

Nutrition of Nitrogenous Bacteria. MME. HÉLÈNE KRZEMIENIEWSKA (*Bull. Acad. Sci. Cracow*, 1908, 445—448).—The presence of potassium salts are essential for the nutrition of nitrogenous bacteria.

Gerlach and Vogel's statement (*Centr. Bakt. Par.*, ii, **10**, 636) to the opposite effect is due to the fact that small amounts of potassium salts were always present in the media used in these experiments. J. J. S.

Formation of Acid by the Diphtheria Bacillus. C. LUBENAU (*Arch. Hygiene*, 1908, **66**, 305—335).—The production of acid by Löffler's bacillus depends (as is well known) on the presence of carbohydrates in the broth; when the latter is free from carbohydrates, alkali is produced, but only under ærobic conditions. Diphtheroid organisms produce less acid on the whole, and do not form appreciable quantities of alkali. True diphtheria bacilli may produce acid, even in the absence of carbohydrates, if grown in a bouillon in which the proteins have been partly decomposed by a fourteen days' growth of *Bacillus coli*; the acid seems to be derived from the proteins. The addition of glycerol to the culture medium causes the diphtheria bacillus to accelerate its production of acid in the first few days, whilst in the case of diphtheroid organisms the acceleration does not occur until later. G. B.

Part Played by Yeasts in the Aldehydification of Alcohol. J. AUGUSTE TRILLAT and SAUTON (*Compt. rend.*, 1908, **147**, 77—80. Compare this vol., ii, 615).—Previous experiments have shown that living yeasts have a greater effect in the formation of aldehyde than yeasts sterilised by heat. Repetition of these experiments, in which the yeast was killed by antiseptics, gave similar results. Thus, living yeast gave 1100 mg. of aldehyde per 100 grams of alcohol, yeast killed by mercuric chloride gave no aldehyde, that killed by formaldehyde gave traces, whilst after sterilisation by heating at 120°, by means of salicylic acid, and by sodium fluoride, less than 100 mg. of aldehyde were formed. Moreover, increase in the proportion of alcohol present lowers the yield of aldehyde, the alcohol acting as an antiseptic. When yeast cells are killed by the action of chloroform and shaken with 10% alcohol, only traces of aldehyde are produced, and the clear filtrate produced when yeast is crushed in a Borrel apparatus is similarly inactive. If ethyl alcohol is replaced by methyl, propyl, butyl, *iso*butyl, or amyl alcohol, the corresponding aldehyde is never formed. The proportions of aldehyde and ethyl acetate formed depend on the duration of the experiment; thus immediately after agitation, 1100 mg. of aldehyde, but no ethyl acetate, were found, whereas after four days the amount of acetate was 316 mg., and of aldehyde less than 100 mg. This is probably to be explained by the formation of ethyl acetate from the acetic acid resulting from the oxidation of the aldehyde (compare Kayser and Demolon, Abstr., 1907, ii, 714; this vol., i, 317). It is found, also, that yeasts accelerate the production of ethyl acetate in a solution of alcohol and acetic acid.

The rapid disappearance of the aldehyde previously described occurs only under the influence of living, not of dead, yeasts.

The conclusions are drawn that the production of aldehyde reaches its maximum in presence of the living yeast cell, that it is not effected by the juice contained in the cell, and that the phenomenon is peculiar to ethyl alcohol. E. H.

Malic Acid in the Production of Wine. Malo-lactic Fermentations. W. Mestrezat (*J. Pharm. Chim.*, 1908, [vi], **28**, 13—20. Compare Abstr., 1907, ii, 903).—The malic acid of grape-juice partly disappears during fermentation, but no lactic acid is formed, and the "malo-lactic" fermentation of Rosenstiehl (*Rev. viticole*, **29**, 509) does not exist. During the ripening of the wine, the malic acid undergoes a further slight diminution. G. B.

The Depression of Fusel Oil Formation, and the Part Played by Bacteria in the Formation of the Higher Alcohols during Fermentation. Hans Pringsheim (*Biochem. Zeitsch.*, 1908, **10**, 490—497).—If ammonium sulphate is added as a source of nitrogen, the amount of amyl alcohol formed from leucine is diminished. The addition of 500 and 1000 grams of the sulphate to 2000 litres of mash, diminished the fusel oil yield from 5 to 2 litres; the addition of 250 grams of salt caused a diminution to 2·5 litres. In the fusel oil, *n*-butyl alcohol was found in very appreciable quantities when ammonium sulphate was added to the mash. In the fusel oil obtained when this addition was not made, *iso*propyl alcohol was found. These alcohols are probably due to the action of bacteria. S. B. S.

Transformation of Starch in Plants. Wl. Butkewitsch (*Biochem. Zeitsch.*, 1908, **10**, 314—344).—The change of starch into sugar which is carried out by bark and wood is due to ferment action, and the diastase was obtained in concentrated form by precipitation of aqueous extracts with alcohol. The bark also inverts maltose. Various conditions, such as changes of temperature on the activity of the ferments, are described. W. D. H.

The Hydrolytic and Catalytic Ferments Acting during the Process of Ripening of Fruit. GIUSEPPE TALLARICO (*Chem. Zentr.*, 1908, i, 1563—1564; from *Arch. Farm. sperim.*, 1908, 7, 27—48).—Bananas were employed for the study; from this fruit, gathered in different stages of ripening, extracts were made. The catalytic action was determined by investigating the action of the extract on hydrogen peroxide; the amylolytic, by its action on starch; the proteolytic, by the action on gelatin, and the inverting, by the action on sucrose. The following enzymes were present: catalase, invertase, amylase, tyrosinase, and a proteolytic enzyme. The catalytic action is very intense so long as the fruit is green and during ripening; it weakens as the fruit gets black. The amylolytic action takes place when the fruit is green or at the beginning of the stage of ripening; it then disappears. The inverting action is almost entirely absent during the green stage, is intense during ripening, and then gradually disappears. The proteolytic action manifests itself during ripening, and then probably gets weaker. S. B. S.

Carrotene from Carrots and the Substances which accompany it. HANS EULER and EBBA NORDENSON (*Zeitsch. physiol. Chem.*, 1908, 56, 223—235. Compare Willstätter, Abstr., 1907, i, 865; Arnaud Abstr., 1885, 670; 1886, 711; 1887, 859).—When fresh carrots are ground with sand, it is found that the expressed juice contains only a portion of the carrotene. The following substances have been extracted from carrots (23 kilos.): Phosphatides, lecithin, &c., 13; daucosterol, 0·5; phylosterol, 1·3; carrotene and xanthophyll, 0·7; oil of unknown composition, 3·5 grams. The following method of extraction is recommended: Boil with water, press, dry in absence of air, extract with carbon disulphide, and then with alcohol. Distil, dissolve in small amount of light petroleum, and precipitate the phosphatides with alcohol. The carrotene and xanthophyll can be thrown down by the addition of suitable salts to the solution, and can be separated by Willstätter's method.

Daucosterol, $C_{26}H_{42}O_4$ (?), crystallises from boiling alcohol in flocculent masses consisting of microscopic needles, m. p. 283°, and gives the Salkowski-Hesse reaction.

An analysis of the purified phosphatides gave the ratio $N : P = 1 : 0·6$.

When carrotene is oxidised with a small amount of an acetic acid solution of chromic anhydride, care being taken that the temperature does not rise above 30—40°, an *oil*, $C_{40}H_{56}O_8$ or $C_{40}H_{60}O_8$, which does not solidify at $-10°$ is obtained. Phytosterol was not obtained when the carrotene employed was quite free from this compound.

J. J. S.

The Endo- and Ekto-invertase of the Date. A. E. VINSON (*J. Amer. Chem. Soc.*, 1908, 30, [vi], 1005).—The invertase of the date remains insoluble in all ordinary solvents throughout the green stages, but becomes readily soluble on ripening, that is, it changes from an endo- to an ekto-form. The change in the behaviour of the invertase towards solvents coincides very closely in point of time with the passage of the tannin into the insoluble form. Evidence is, however, adduced to show that the two phenomena are not causally connected; thus glycerol will dissolve date invertase in presence of soluble tannin, but it fails to extract invertase from green dates. Tannin, however, renders invertase insoluble in water.

It does not appear that the invertase is altered in changing from the insoluble to the soluble form. The rates of inversion of sucrose by equivalent amounts of green and of ripe date pulp are practically identical. Picric acid, chromic acid, and formaldehyde retard the action of green and ripe pulp to approximately the same degree. The living protoplasm does not appear to be directly connected with the inversion, since neither ether, chloroform, nor acetone render inactive the green tissue.

The author explains the difference in solubility by supposing that in the case of the green date the enzyme forms an insoluble compound with some constituent of the protoplasm; on ripening, the protoplasm undergoes profound change, and the enzyme is liberated. He examines and rejects the alternative view, that the cell wall of the green tissue is semi-permeable, whilst that of the ripe tissue is not. E. J. R.

Transitory Presence of Hydrogen Cyanide in Ferns. MAURITS GRESHOFF (*Pharm. Weekblad*, 1908, **45**, 770—773).—The author has detected hydrogen cyanide in ferns, such as *Gymnogramme aurea*, *G. lastrea*, and *G. athyrium*. The percentage varied between 0·056 in very young fronds and 0·006 in old fronds, and always diminished with increase in the age of the material examined. A. J. W.

Chemical Examination of Ipomœa purpurea. FREDERICK B. POWER and HAROLD ROGERSON (*Amer. J. Pharm.*, 1908, **80**, 251—286).—The chief constituent dissolved by alcohol is a resin, from which by extraction with various solvents the following substances were obtained: pentatriacontane, a phytosterol ($C_{27}H_{46}O$, m. p. 132—133°, $[\alpha]_D$ $-32·1°$, probably identical with sitosterol; compare Abstr., 1903, ii, 517), several fatty acids, a new crystalline alcohol, *ipuranol*, $C_{23}H_{38}O_2(OH)_2$, m. p. 285—290°, and a new acid, termed *ipurolic acid*, $C_{18}H_{25}(OH)_2·CO_2H$, silky needles, m. p. 100—101°.

Ipuranol yields an *acetyl* derivative, m. p. 160° (not analysed); from the acid, the *sodium* salt, $C_{13}H_{25}(OH)_2·CO_2Na,H_2O$, the *silver* salt (m. p. 160°), the *methyl* ester, $C_{13}H_{25}(OH)_2·CO_2Me$, m. p. 68—69°, the *monomethyl ether* of methyl ipurolate, $OH·C_{13}H_{25}(OMe)·CO_2Me$, m. p. 64—65°, and the *diphenylurethane* of methyl ipurolate,

$$C_{13}H_{25}(O·CO·NHPh)_2·CO_2Me,$$

m. p. 96—97°, were prepared. By decomposition of the various resin fractions with potassium hydroxide and with barium hydroxide, there were obtained a number of acids, including α-methylbutyric acid, $[\alpha]_D$ +17·95°, *α-hydroxylauric* acid, $C_{12}H_{24}O_3$, m. p. 69—70°, and probably azelaic acid. The drug also contains a minute quantity of an essential oil. G. B.

"Bourgou" (Panicum stagninum); a Sacchariferous Grass. E. PERROT and EUGÈNE TASSILLY (*Bull. Soc. chim.*, 1908, [iv], 3, 740—742).—A sample of this grass collected in Upper Senegal was found to contain 10% of sucrose, 7% of reducing sugars, calculated as dextrose, some emulsin, but no invertase or glucosides capable of being hydrolysed by emulsin. T. A. H.

Influence of Manures and Soil Moisture on the Disposition and Perfection of the Ears and the Club Shape of Göttingen Square-head Winter Wheat. W. OHLMER (*J. Landw.*, 1908, **56**, 153—171; from *Inaug. Diss. Göttingen*, 1907).—The wheat was grown in zinc vessels and pots containing loam, with different manures; the amounts of water were 45% and 70% of the water capacity of the soil.

It is shown that the club shape becomes more marked when the nitrogen supply is increased, whilst a high percentage of moisture in the soil is unfavourable. N. H. J. M.

The Storage and Transportation of Sucrose in the Beet (Beta vulgaris). FRIEDRICH STROHMER (*Chem. Zentr.*, 1908, i, 1469—1470; from *Oesterr.-ung. Zeitsch. Zuckerind. Landw.*, 37, 18—21).—In the second year of growth, at the time of flowering, the cane sugar disappears from the roots, and is employed for building up the parts of the plant above the earth. At this time, both in the main stem and in the branches, more invert sugar is found than sucrose, so that hydrolysis into monosaccharides of the latter first takes place, when it is transported, the hydrolysis being followed by re-synthesis. The exposure to light has great influence on the store of sugar; plants which have been kept in the shade half the day during the whole period of growth yield only one-fourth to one-half as much sugar as those which, growing under otherwise similar conditions, have been exposed to full light for the whole day. The plants grown in the shade yielded larger quantities of other products of non-carbohydrate nature, and had consequently considerably less technical value. S. B. S.

Manuring Experiments with Calcium Cyanamide for Potatoes. ALBERT STUTZER (*J. Landw.*, 1908, **56**, 141—144).—The potatoes were grown on plots of 100 square metres, without nitrogenous manure, and with 250, 500, and 750 grams of sodium nitrate, "Stickstoffkalk," and ammonium sulphate respectively. Sodium nitrate gave lower yields than "Stickstoffkalk," probably owing to the large amount of rain; the percentage of starch was, however, highest when sodium nitrate was employed. The highest yields per acre of dry matter and starch were obtained on the plot which received 500 grams of "Stickstoffkalk." N. H. J. M.

[Nutritive Value of Non-Proteins in Hay.] MAX MÜLLER (*J. Landw.*, 1908, **56**, 192—193. Compare this vol., ii, 220).—The hay extract employed in the feeding experiments previously described (Abstr., 1907, ii, 645) contained 1·87% total N by Jodlbaur's method and 1·84% by Kjeldahl's. The results obtained with blood-albumin have been confirmed by further determinations. N. H. J. M.

Persistence of the Nitrogen of Green Manure in a Light Sandy Soil. Conrad von Seelhorst (*Mitt. deut. landw. Ges.*, 1908, **23**, 83—89, 139—144).—Experiments with different plants grown with green manures in a sandy soil in iron boxes having an area of 1 square metre. The nitrogen in the crops was determined, and also the amount per month and nitrogen content of the drainage. The experiments commenced in 1904 (compare *ibid.*, 1906, **21**, 289—292, 295—299).

The decomposition of green manure in sandy soil is so rapid that, when applied in October, half the nitrogen may be washed out in the drainage by February or March when the winter has been mild and wet. When applied in February, the decomposition would be still more rapid; the loss of nitrogen is then, however, reduced partly by its being taken up by the growing crop and partly by the amount of drainage being diminished.

The amount of nitrogen was determined in the rain collected in Göttingen in 1906, and the following results obtained:

	Rainfall.	Nitrogen.			Rainfall.	Nitrogen.	
	mm.	per million.	kg. per hec.		mm.	per million.	kg. per hec.
January...	48·7	1·40	0·68	July	124·1	0·72	0·89
February	47·9	1·40	0·67	August ...	79·3	1·26	1·00
March ...	78·3	0·47	0·37	September	59·7	1·85	1·10
April	28·9	0·91	0·26	October...	25·1	1·47	0·37
May	95·6	1·26	1·20	November	53·1	0·84	0·45
June	84·3	1·25	1·05	December	46·8	1·41	0·66

The rainfall for the year was 771·8 mm., and the total nitrogen 8·718 kilos. per hectare, or 1·13 per million of rain water.

N. H. J. M.

Action of Organic Nitrogen Manures as Compared with Sodium Nitrate. Max Popp (*Landw. Versuchs-Stat.*, 1908, **68**, 253—300).—Blood meal and horn meal in quantities containing (1) 0·2 and (2) 0·4 gram of nitrogen in each case were mixed with soil (250 grams), and the amounts of nitrogen as ammonia and nitrates determined in water extracts at the commencement and after two, six, and twelve weeks. The following amounts of nitric nitrogen, as percentages of total N, were found:

	At commencement.		2 weeks.		6 weeks.		12 weeks.	
	1	2	1	2	1	2	1	2
Blood meal	0	0	17	8	70	66	72	72
Horn meal	0	0	10	1	54	45	59	57

The amounts of ammonia were very small, except after two weeks, when the nitrogen in that form amounted to 6—13%. Similar experiments, in which calcium carbonate was also added, generally gave very slightly higher results.

Vegetation experiments extending over five or six years are described, in which different crops were grown successively in large cylinders and manured with a variety of organic manures. The approximate values of the different manures as compared with sodium nitrate were found to be as follows: blood meal and horn meal, 70; fish meal, ricinus meal, and meat meal, 60; Bremer poudrette and bone meal, 55; molasses manure, 40; wool dust, 25, and leather meal, 10. N. H. J. M.

Gaseous Compounds produced by the Decomposition of Calcium Cyanamide and their Action on Plant Growth. EMIL HASELHOFF (*Landw. Versuchs-Stat.*, 1908, 68, 189—228).—Calcium cyanamide mixed with soil and basalt sand gave off 3·78 and 4·26% of the total nitrogen as ammonia in eight days. In three days, 50 grams of the manure yielded 0·00068 gram of hydrogen phosphide, but no hydrogen sulphide, and in the same length of time 10 grams gave 0·0795% of acetylene.

Results of experiments on germination in presence of the different gases make it probable that the injurious action of calcium cyanamide is due to free ammonia and perhaps also to hydrogen phosphide. Acetylene was found to have no injurious action on germination.

Experiments were also made in soil and water culture on the action of the different gases. The results showed that small amounts of free ammonia, hydrogen phosphide, and hydrogen sulphide are injurious to growth. N. H. J. M.

Absorption of Calcium Cyanamide in Soil. HUBERT KAPPEN (*Landw. Versuchs-Stat.*, 1908, 68, 301—331).—The absorptive power of soils causes the decomposition of calcium cyanamide into lime and cyanamide. The latter compound is also produced by the action of carbon dioxide, and its production is rapid when both actions occur simultaneously. The formation of cyanamide is favourable to vegetation, since it is more readily attacked by bacteria than the strongly alkaline calcium compound.

In soils of low absorptive power, the transformation of calcium cyanamide is slower, and, under these conditions, injury to germination and plant growth, due to poisonous cyanamide compounds, may occur.

The influence of absorption is only indirect, conditions being produced which are favourable to the rapid conversion of poisonous compounds into harmless substances. N. H. J. M.

Factors which Influence the Manurial Action of Sparingly Soluble Phosphates. HENRIK G. SÖDERBAUM (*Landw. Versuchs-Stat.*, 1908, 68, 433—450).—Oats and barley were grown in pots in a sandy soil, deficient in nitrogen and phosphoric acid, manured with different phosphates in conjunction with nitrogen in different forms.

Oats manured with tricalcium phosphate gave slightly lower results with ammonium nitrate and slightly higher results with ammonium sulphate than when sodium nitrate was employed. In the case of barley manured with bone meal, ammonium nitrate caused a similar depression as compared with sodium nitrate, whilst ammonium sulphate reduced the yield 46·6%. A mixture of sodium nitrate and ammonium sulphate, however, increased the yield (4·1%) as compared with sodium nitrate alone. Tricalcium phosphate, ammonium sulphate, and potassium sulphate gave somewhat higher results (with oats) than when potassium chloride was employed, whilst bone meal, ammonium sulphate, and potassium chloride gave distinctly better results (with barley) than when potassium sulphate was used.

In a subsequent series of experiments, ammonium salts (both nitrate and sulphate) in conjunction with tricalcium phosphate and bone meal respectively considerably increased the yield of oats as compared with sodium nitrate. Barley manured with bone meal and ammonium nitrate gave higher results than with sodium nitrate, whilst tricalcium phosphate and ammonium nitrate gave lower results. Both phosphatic manures (especially tricalcium phosphate) gave much lower results with ammonium sulphate than with sodium nitrate. Addition of equivalent amounts of sodium carbonate to ammonium sulphate in conjunction with bone meal increased the yield of barley, the total produce being then slightly higher (1·1%) than with sodium nitrate and bone meal. In the case of tricalcium phosphate, addition of sodium carbonate with ammonium sulphate nearly doubled the yield obtained with ammonium sulphate and tricalcium phosphate; the yield, however, was still more than 50% below that obtained with sodium nitrate and tricalcium phosphate.

Sodium carbonate in conjunction with ammonium sulphate and phosphates very slightly reduced the yield of oats as compared with ammonium sulphate and phosphates alone.

The changes in the physiological reaction caused by different nitrogenous compounds will not only vary with different plants, soils, and with different amounts and kinds of the other manures employed, but may even be reversed. N. H. J. M.

Analytical Chemistry.

Absorption Bulbs for use with Bottles containing Standard Solutions, &c. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. Sucr. Dist.*, 1908, 25, 1077).—A piece of apparatus is described which may be fitted to bottles containing standardised alkali solutions in order to prevent the entrance of carbon dioxide, &c., to the bottle when the solution is drawn off into a burette. It consists of a bulb provided with a side-tube reaching to the bottom of the bulb; the air enters by this tube and, after bubbling through potassium hydroxide solution or other absorbent placed in the bulb, leaves through a tube at the top of the bulb. This tube is bent downwards so that it can be fixed through a hole in the cork of the bottle. By slightly altering its form, the bulb may be used to absorb the gases formed during fermentation experiments, and for other purposes. W. P. S.

Replacement of Hydrogen Sulphide in Chemical Analysis. Eduard Donath (*Chem. Zeit.*, 1908, **32**, 629—630, 645—647).—The author recommends the process used by Vortmann chiefly on hygienic grounds.

This process is, briefly, as follows: the solution is made alkaline with sodium hydroxide and then heated with excess of pure sodium sulphide, which dissolves the metals of the tin group. The insoluble matter is then treated with dilute hydrochloric acid, which dissolves all but the sulphides of those metals which are precipitated in the usual course with hydrogen sulphide; cobalt and nickel are also left undissolved. For furthur details, Vortmann's brochure is referred to.

In order to prepare ammonium sulphide without using a hydrogen sulphide apparatus, distillation of sodium sulphide with ammonium chloride solution is recommended. L. de K.

Use of Certain Organic Acids and Acid-Anhydrides for the Standardisation of Alkali and Acid Solutions. Isaac K. Phelps and L. H. Weed (*Zeitsch. anorg. Chem.*, 1908, **59**, 114—119). —Experiments are recorded which show that succinic acid, succinic anhydride, malonic acid, benzoic acid, phthalic acid, and phthalic anhydride can be used, with phenolphthalein as indicator, for the titration of sodium and barium hydroxide solutions with the same degree of accuracy as a solution of hydrochloric acid standardised by precipitation with silver nitrate. H. M. D.

Comparison between Succinic Acid, Arsenious Oxide, and Silver Chloride for the Standardisation of Solutions in Iodimetry, Alkalimetry, and Acidimetry. Isaac K. Phelps and L. H. Weed (*Zeitsch. anorg. Chem.*, 1908, **59**, 120—126. Compare preceding abstract).—Succinic acid can be accurately employed for the standardisation of sodium thiosulphate solutions. The authors' method consists in standardising a pure sodium hydroxide solution by means of succinic acid. This solution is used to titrate a solution of a mineral acid, a known quantity of which is added to an excess of solution containing potassium iodide and iodate. The thiosulphate solution is then used to titrate the liberated iodine. Results quite as accurate as those yielded by the estimation of iodine with a standard arsenious oxide solution are obtainable. The liberation of iodine by mineral acids from an iodide-iodate solution is not complete in very dilute solution. H. M. D.

Separation of Chlorine, Bromine, and Iodine by means of Hydrogen Peroxide in Acid Solution. Paul Jannasch (*J. pr. Chem.*, 1908, [ii], **78**, 28—34).—In continuation of the study of the separation of the halogens by means of hydrogen peroxide, a method has been worked out for the quantitative separation of chlorine, bromine, and iodine from each other. The haloid mixture is made acid with acetic acid and treated with hydrogen peroxide; the iodine is then distilled off in a current of carbon dioxide, collected in an aqueous solution of ammonium hydroxide and hydrazine sulphate, and estimated as described previously (Abstr., 1906, ii, 194). The bromine and chlorine in the distillation residue are separated and estimated as before (Abstr., 1906, ii, 894), with the difference that the bromine is collected in a solution of sodium, instead of ammonium, hydroxide and hydrazine sulphate. The analyses quoted show that the method gives good results for chlorine and iodine, but that bromine is found slightly too low. G. Y.

Detection and Estimation of Chlorites and Hypochlorites in Chlorates. Birger Carlson and Julius Gelhaar (*Chem. Zeit.*, 1908, 32, 604—605, 633—634).—*Qualitative Examination of Chlorates.*—Five grams of the sample are dissolved in 100 c.c. of cold water and a drop of zinc iodide-starch solution is added. If no immediate blue colour is noticed, hypochlorites are absent. Two c.c. of $N/10$ sulphuric acid are now added, and if there is no immediate coloration, neither hypochlorites nor chlorites are present. These directions must be strictly adhered to.

Quantitative Estimation.—The following is an outline of the method employed: The hypochlorite is titrated in the usual manner with arsenious acid, the excess of which is then titrated with iodine. To another portion of the solution is now added the requisite amount of arsenic solution to destroy the hypochlorite, and, after diluting to 250 c.c. and heating to 95°, the solution is titrated as quickly as possible with indigo solution; if neutral or alkaline, the liquid should be acidified faintly with dilute sulphuric acid. The indigo solution is prepared by dissolving about 6 grams of sodium indigotinsulphonate in a litre of water, and should be checked with a solution of chlorite, checked in turn with standard iodine and thiosulphate. L. de K.

Estimation of Sulphur in Iron and Steel. Max Orthey (*Zeitsch. angew. Chem.*, 1908, 21, 1359—1364, 1393—1399).—The following published processes may be recommended. They are all based on the evolution of the sulphur as hydrogen sulphide and absorption of the latter in cadmium acetate solution; the cadmium sulphide is converted by means of copper sulphate into copper sulphide, which is then burnt to oxide (1, 2, 3, 4), or the cadmium sulphide is estimated iodometrically (5, 6):

(1) The sample is treated with hydrochloric acid, D 1·19. (2) The gases are passed through a red-hot tube. (3) The hydrochloric acid fumes are condensed in a little water, which is afterwards boiled to expel any hydrogen sulphide. (4) A mixture of zinc and cadmium acetate is used. (5) An ammoniacal solution of cadmium acetate is used. (6) An acetic acid solution is employed.

In the case of steel, the following methods may be used also: (7) The sample is dissolved in dilute hydrochloric acid (1 : 2), and the gases passed through a red-hot tube. (8) Acid, D 1·124, is used, and the gases ignited. (9) The same, but a mixture of dilute hydrochloric acid (1 : 2) and dilute sulphuric acid (1 : 4) is used instead. For reference, analyses 3, 4, 5, and 6 should be used.

Good results are obtained also by the following methods, where the sulphur is finally weighed as barium sulphate: (*a*) The sample is dissolved in strong hydrochloric acid, and the heated gases are passed through ammoniacal hydrogen peroxide. (*b*) The sample is oxidised with nitric acid, D 1·42, the nitric acid is expelled by excess of hydrochloric acid, and the ferric chloride removed by shaking with ether; or the iron is precipitated with ammonia, and, after adding barium chloride, the ferric hydroxide is re-dissolved by hydrochloric acid. (*c*) The iron is treated with copper-ammonium chloride, and the residual matter oxidised with nitro-hydrochloric acid and potassium chlorate. L. DE K.

Decomposition of Certain Minerals and Industrial Products by means of Sodium Peroxide and Metallic Sulphides. JAMES H. WALTON, JUN., and HERMAN A. SCHOLZ (*Amer. Chem. J.*, 1908, **39**, 771—789).—A method is described for decomposing certain mineral substances, and is particularly applicable to sulphide ores and products containing a large proportion of silica, such as glazes and slags. The decomposition is effected by fusing the material in a nickel crucible with a mixture of sodium peroxide, zinc sulphide, and potassium persulphate. In the case of basic substances, such as franklinite and chrome iron ore, iron pyrites is added in order to increase the temperature.

The method yields accurate results, and is very rapid; the silica is brought into solution, and therefore does not tend to clog the filters, and the use of platinum crucibles is obviated. E. G.

Colorimetric Estimation of Phosphorus in Steel. G. MISSON (*Chem. Zeit.*, 1908, **32**, 633).—The reagents required are (1): Pure nitric acid, D 1·2. (2) Potassium permanganate, 8 grams per litre. (3) Pure hydrogen peroxide, prepared by introducing gradually 40 grams of sodium peroxide into a cold mixture of 900 c.c. of water and 100 c.c. of nitric acid. (4) Ammonium vanadate, prepared by dissolving 2·345 grams of the salt in 500 c.c. of water, adding 20 c.c. of nitric acid, and diluting, when cold, to one litre. (5) A freshly-prepared 10% solution of ammonium molybdate.

One gram of the sample is dissolved in 20 c.c. of reagent (1), and boiled and mixed with 10 c.c. of reagent (2). After boiling a few seconds longer, 10 c.c. of reagent (3) are added to redissolve the manganese precipitate, then 10 c.c. of reagent (4), and the excess of peroxide is removed by boiling. When cold, the liquid is diluted to 60—65 c.c., 10 c.c. of reagent (5) are added, and the whole is diluted to 800 c.c. exactly. After two or three minutes, the coloration is compared with that of a standard sample treated similarly; the colour is stable for several days. L. DE K.

Estimation of Phosphoric Acid in Foods. EMIL WÖRNER (*Zeitsch. Nahr. Genussm.*, 1908, **15**, 732—734).—According to the process described, the organic matter of the food is destroyed by heating with sulphuric and nitric acids, the phosphoric acid is then precipitated by the addition of ammonium molybdate solution, and the amount of phosphoric acid in the precipitate is estimated volumetrically.

From 1 to 5 grams of the dry sample are heated in a flask with 5 c.c. of concentrated sulphuric acid and 5 c.c. of nitric acid until the nitric acid has been expelled and fumes of sulphuric acid are evolved. If the remaining solution is dark in colour, a little more nitric acid is added and the heating continued. The solution is cooled, diluted with 20 c.c. of water, boiled for a short time, and filtered to remove silica and any trace of undecomposed fat. The filtrate, amounting to 100 c.c., is then treated with 30 c.c. of 50% ammonia, heated to a temperature of about 80°, and 25 c.c. of 10% ammonium molybdate solution are added. The mixture is shaken for a short time and, after the lapse of fifteen minutes, filtered, and the precipitate washed with water by decantation until free from acid. The filter is next placed in the flask containing the precipitate, 150 c.c. of water are added, a measured quantity of *N*/2 sodium hydroxide solution (about 5 c.c. more than is required to dissolve the precipitate) is introduced, and the contents of the flask are boiled until all the ammonia has been expelled. The excess of sodium hydroxide is then titrated back, using phenolphthalein as indicator. Each c.c. of *N*/2 sodium hydroxide solution is equivalent to 0·001268 gram of phosphoric anhydride or to 0·000556 gram of phosphorus. W. P. S.

Estimation of Phosphates in Urine. ANNIBALE FERRARO (*Boll. chim. farm.*, 1908, **47**, 399—400).—In the estimation of phosphates in urine by Neubauer's method, the uranium solution must be run in in drops throughout, with brisk agitation, the solution to be tested being kept at the temperature of the boiling-water bath. The last reading should be taken after six to seven minutes of rapid stirring. When much calcium phosphate is present, it is better to run the solution to be tested from a burette into the uranium solution. Potassium ferrocyanide is to be preferred to cochineal as an indicator.

C. H. D.

The Dyer Method for the Determination of Plant Food in Soils. FRANK T. SHUTT and A. T. CHARRON (*J. Amer. Chem. Soc.*, 1908, **30**, [iv], 1020).—Experiments are recorded showing the effect of (1) the time of digestion and (2) the volume of the solvent in making analyses of soil by Dyer's method (Trans., 1894, **65**, 115). The authors used a rich black loam from the prairie at Tisdale, Sask., described as typical of large areas in the Canadian north-western wheat belt, and characteristically rich in nitrogen and organic matter. Four sets of determinations were made: samples weighing 100 grams of soil were extracted for (*a*) seven days, (*b*) five hours, with 1000 c.c. of 1 per cent. citric acid, and (*c*) seven days, (*d*) five hours, with 500 c.c. of 1 per cent. citric acid; the results were:

	P_2O_5, per cent.	K_2O, per cent.	CaO, per cent.
Seven day digestion, 1000 c.c. solvent (*a*) ...	0·02287	0·03818	0·5320
,, ,, 500 c.c. ,, (*c*) ...	0·01999	0·03355	0·2718
Five hour digestion, 1000 c.c. ,, (*b*) ...	0·01807	0·03958	0·5210
,, ,, 500 c.c. ,, (*d*) ...	0·01599	0·03089	0·2285

A reduction in the volume of the solvent has materially reduced the percentages of phosphoric acid, potash, and especially of lime obtained; reduction in the time of digestion has caused a falling off in the amount of phosphoric acid, has scarcely affected the lime, and not at all the potash. It is evident that the volume of the solvent is a more important matter than the time of digestion. E. J. R.

Detection of Arsenic in Urine. Ernst Salkowski (*Zeitsch. physiol. Chem.*, 1908, **56**, 95—114).—The paper is mainly concerned with methods for oxidising the urine prior to the application of Marsh's test. The method recommended is to oxidise the evaporated alcoholic extract of the urine by treatment with 15 c.c. of nitric acid (D 1·48), and then to heat the mixture with 10 c.c. of sulphuric acid in a Kjeldahl flask, occasionally adding 0·5 c.c. of nitric acid until oxidation is complete. Various other practical details are discussed. G. B.

Iodometric Estimation of Arsenic and Antimony in the Presence of Copper. F. H. Heath (*Amer. J. Sci.*, 1908, [iv], 513—519; *Zeitsch. anorg. Chem.*, 1908, **59**, 87—93).—The solution, which must contain the arsenic or antimony in the higher state of oxidation, is mixed with 1—2 grams of citric acid and then with potassium iodide (3 grams to 50 c.c., 5 grams to 100 c.c.). The iodine liberated, which represents the copper, is then titrated with standard thiosulphate. The filtrate from the cuprous iodide is treated with 1 c.c. of bromine and boiled in order to expel the iodine, if necessary with further addition of bromine, which is then in turn boiled off completely. The whole is now diluted to 100 c.c., and, after adding 2 grams of potassium iodide, the solution is boiled down to half its bulk. When cold, any free iodine is decolorised with sulphurous acid, using starch as indicator. After diluting again to 100 c.c., iodine solution is added until the liquid is coloured, and then very dilute sulphurous acid to make the colour disappear. Excess of sodium hydrogen carbonate is now added, and the arsenic or antimony titrated with standard iodine in the usual way.

When both arsenic and antimony are present, the copper estimation is not quite so satisfactory. L. de K.

Parr's Method of Determining the Heat of Combustion of Coal. Emil J. Constam (*Zeitsch. angew. Chem.*, 1908, **21**, 1414).—Polemical. A reply to Parr (this vol., ii, 533). P. H.

Volumetric Estimation of Carbon Dioxide and other Acids in Air. H. Henriet and M. Bouyssy (*Compt. rend.*, 1908, **146**, 1100—1101).—The air is passed through standardised sodium or potassium hydroxide solution, and the latter is then diluted to a definite volume. One-half is next titrated with acetic acid, using phenolphthalein as indicator, and the decrease in titre of the solution multiplied by 2 is equivalent to the amount of carbon dioxide in the air; the neutral point is reached when the normal carbonate formed has been converted into hydrogen carbonate. The second half of the solution is then treated with barium chloride, and titrated with acetic acid without removing the barium carbonate. The quantity of alkali required to neutralise the total acidity of the air is thus obtained, and the amount of the acids other than carbon dioxide may be calculated. W. P. S.

The Autolysator, an Apparatus for the Automatic Estimation of Carbon Dioxide. Charles A. Keane and Harry Burrows (*J. Soc. Chem. Ind.*, 1908, **27**, 608—610).—The apparatus is used for the automatic analysis of furnace gases. The absorption of the carbon dioxide is effected by means of soda-lime, and the pressure of the gas before and after the absorption is measured by differential manometers. The gas to be analysed is drawn by water suction of constant pressure through two similar capillary tubes, each of which is connected with a manometer. By interposing the absorbent substance between the two capillaries, the difference in pressure due to the absorption of the carbon dioxide is indicated on the manometer, provided that the flow of gas be so regulated that a constant volume flows through the apparatus. A full description, with diagrams, of the apparatus is given in the original paper. W. P. S.

Application of the Cobaltinitrite Method to the Estimation of Potassium in Soils. W. A. Drushel (*Zeitsch. anorg. Chem.*, 1908, **59**, 97—101. Compare this vol., ii, 66).—The method already described is applied to the estimation of potassium in soils. A weighed quantity of soil is extracted on the water-bath with 20% hydrochloric acid. The acid is then removed by evaporation, and the bases separated by addition of sodium carbonate or ammonia and ammonium oxalate. After removal of the ammonium salts and the organic matter by heating to redness, the residue is dissolved in water, acidified with acetic acid, and evaporated with excess of sodium cobaltinitrite. The further procedure is exactly the same as that previously described (*loc. cit.*). H. M. D.

Estimation of Lead in Alloys. W. Elborne and C. M. Warren (*Chem. News*, 1908, **98**, 1).—One gram of the alloy in fine shavings is put into a flask with 50 c.c. of hydrochloric acid, and a slow current of chlorine is passed for twenty-four hours. When all is dissolved (sometimes heat must be applied towards the end), the solution is transferred to a small weighed porcelain dish, evaporated to dryness on a water-bath, and the residue cooled in a desiccator.

The mass is then treated repeatedly with absolute alcohol; this dissolves all the chlorides present except the lead chloride, which is then dried at 100° for three hours and weighed. For fear any lead chloride may be lost, the filtrate and washings are passed through a weighed filter, which is then also dried at 100°. L. de K.

Rapid Valuation of Pastilles of Mercuric Chloride and Cubes of Sodium and Potassium Iodides. Paolo Fiora (*Boll. chim. Farm.*, 1908, **47**, 401—402).—The mercuric chloride pastille (1 gram) is dissolved in water, and a solution of 1·162 grams of potassium iodide added. After filtering, a 1% solution of mercuric chloride is added, the formation of a precipitate indicating a deficiency in the pastille. The quantity given allows a margin of 0·05 gram. For 1 gram cubes of potassium and sodium iodides, 0·776 and 0·859 gram of mercuric chloride are added respectively, a very dilute solution of potassium iodide being used for titrating back.

C. H. D.

Estimation of Cerium in the Presence of Other Rare Earths by the Action of Potassium Ferricyanide. Philip E. Browning and Howard E. Palmer (*Amer. J. Sci.*, 1908, [iv], **26**, 83—84; *Zeitsch. anorg. Chem.*, 1908, **59**, 71—73).—To a measured portion of the cerous sulphate (containing about 0·1 gram of cerium), which may contain also the sulphates of the other rare earths, are added 20 c.c. of 2% ferricyanide solution, and then a slight excess of aqueous potassium hydroxide. The precipitate is filtered off, and the filtrate and washings, amounting to about 200 c.c., are slightly acidified with dilute sulphuric acid, and the ferrocyanide formed by the reducing action of the cerous salt is then titrated as usual with standard permanganate; 2 mols. of ferrocyanide = 1 mol. of cerous oxide. L. de K.

Estimation of Iron and Vanadium in the Presence of Each Other. Graham Edgar (*Amer. J. Sci.*, 1908, [iv], **26**, 79—82; *Zeitsch. anorg. Chem.*, 1908, **59**, 74—78).—The process is based on the fact that ferric iron is reduced to the ferrous state both by the action of sulphur dioxide and amalgamated zinc, but in the case of vanadic acid, the reducing action of sulphur dioxide goes as far as V_2O_4 only, but that of zinc to V_2O_2. The difference in permanganate used for re-oxidation after reduction with sulphur dioxide and the second reduction with zinc is a measure for the amount of vanadium present.

The solution is saturated with sulphur dioxide, a few c.c. of dilute sulphuric acid are added, and the liquid boiled in a current of carbon dioxide free from air. When all the sulphur dioxide has been removed, the flask is cooled rapidly, and the liquid titrated with standard permanganate until the colour changes from blue to yellowish-green; the liquid is then heated to 70—80°, and the titration continued. The liquid is now passed through a column of amalgamated zinc contained in a long Jones' reductor, being preceded by 150 c.c. of hot dilute 2½% sulphuric acid. After washing the zinc with 100 c.c. of the acid and then with 200 c.c. of water, the contents of the receiving flask (into which some pure ferric sulphate had been introduced, and which has been kept cool) are mixed with syrupy phosphoric acid and titrated with permanganate until the reaction is nearly at an end; the temperature is then raised to 70—80°, and the titration continued. L. de K.

Simultaneous Volumetric Estimation of Iron and Vanadium [in Ferro-Vanadium]. T. Warynski and B. Mdivani (*Ann. Chim. anal.*, 1908, **13**, 210—212).—Three to four grams of the alloy are treated several times with nitrohydrochloric acid and nitric acid and evaporated to dryness, and the residue is boiled with dilute nitric acid and filtered

off from any silica. The filtrate is then evaporated with addition of hydrogen peroxide, and then again several times with sulphuric acid to expel the nitric acid. The mass is then dissolved in very dilute sulphuric acid, and diluted to 500 c.c.; 100 c.c. are taken for the estimation of the vanadic acid only by Bunsen and Mohr's method (distillation with hydrochloric acid, collecting the distillate in potassium iodide, and determining the iodine liberated). Another 100 c.c. are then taken for the joint estimation of the ferric oxide and vanadic acid by the authors' stannous chloride method (compare this vol., ii, 636).
L. DE K.

Estimation of Chromium as Silver Chromate. FRANK A. GOOCH and L. H. WEED (*Amer. J. Sci.*, 1908, [iv], **26**, 85—86; *Zeitsch. anorg. Chem.*, 1908, **59**, 87—93).—Chromium in the state of chromate or dichromate may be accurately estimated by adding to the solution an excess of silver nitrate, then a slight excess of ammonia, and finally acetic acid to slightly acid reaction. The silver chromate is collected on a Gooch filter, washed first with a dilute solution of silver nitrate to remove any soluble impurities, and then with small portions of water, 20—30 c.c. in all. The precipitate may be dried at 135°, or gently over a naked flame.
L. DE K.

Estimation of Tungstic Acid and its Separation from other Substances by means of a Mixture of Chlorine and Sulphur Chloride. FRANÇOIS BOURION (*Compt. rend.*, 1908, **146**, 1102—1104). —It has been shown previously (Abstr., 1904, ii, 341) that tungsten trioxide when heated strongly in a mixture of chlorine and sulphur chloride yields volatile oxychlorides, and the method now proposed is based on this reaction; it is applicable to the estimation of tungsten trioxide in sodium tungstate, silicotungstic acid, &c. A portion of the sample is placed in a porcelain or silica boat, and is then heated in a glass tube through which a current of chlorine containing a little sulphur chloride is passed. The volatile substances are collected in a receiver containing water, and, when the operation is at an end, the contents of the receiver are evaporated with nitric acid, heated to remove sulphuric acid, the residue is taken up with ammonium nitrate solution, and the tungsten trioxide is collected on a filter and weighed. If any of the oxychloride condenses on the sides of the glass tube, the latter may be rinsed with ammonia and the solution added to the contents of the receiver. The silica may be recovered by extracting the contents of the boat with water and weighing the residue.
W. P. S.

A New Method of Separation of Silica and Tungsten Trioxide. EDOUARD DEFACQZ (*Compt. rend.*, 1908, **146**, 1319—1320. Compare Abstr., 1907, ii, 475; Marignac, *Ann. chim. Phys.*, 1864, [iv], 3, 9; Friedheim, Henderson, and Pinagel, Abstr., 1905, ii, 614; Bourion, preceding abstract).—This is based on the facts that silica is unattacked, but tungsten trioxide is reduced by hydrogen at 600—900° either to lower oxides or to the metal, and that the latter are converted by chlorine into the volatile hexachloride or oxychlorides. The mixture of silica and tungsten trioxide contained in a boat is heated to redness in a current of hydrogen. When the reduction is complete, the boat is introduced into a glass tube bent so as to admit of the condensation of volatile products, and heated in a current of dry chlorine. If the reduction has been complete and all the air has been expelled, a mixture of tungsten hexachloride and oxytetrachloride is volatilised, otherwise the product consists of a mixture of the red and yellow oxychlorides.

The receiver is washed out with dilute ammonia, and the tungsten estimated in one of the known ways. The silica remains in the boat, and should be quite white; it should give no colour reaction when fused with potassium hydrogen sulphate.

The method is generally applicable to mixtures of two oxides, only one of which is reduced by hydrogen to a metal, forming with chlorine a volatile chloride. E. H.

Tables for Converting Percentages of Alcohol by Volume into Percentages by Weight. A. Blondeau (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **25**, 1032—1045).—The tables given show the weights of alcohol corresponding with volumes of alcohol as determined by Gay-Lussac's hydrometer in mixtures of alcohol and water containing from 1 to 100% of alcohol by volume at any temperature between 0° and 30° W. P. S.

Estimation of Alcohol and Extract in Spirits by means of the Refractometer. Joseph Race (*J. Soc. Chem. Ind.*, 1908, **27**, 547—548).—A table is given showing the refractive indices of mixtures of alcohol and water containing from 1 to 100% of alcohol, the indices being given for each difference of 1%. Using this table, it is possible to estimate the quantity of alcohol and extract in a spirit. The refractive index of the spirit is taken at a temperature of 15·5°, and also that of the liquid obtained by evaporating 25 c.c. of the spirit almost to dryness and diluting the residue to the original volume. The difference between these results is due to the alcohol and other volatile constituents, and the difference between the refractive index of the extract and that of water is due to the extractive matters contained in the spirit. W. P. S.

Messinger and Vortmann's Method of Estimating Phenols. Separation of Salicylic Acid. J. Bougault (*Compt. rend.*, 1908, **146**, 1403—1405).—The violet-red compound obtained by Messinger and Vortmann (Abstr., 1889, 1150) by the action of iodine and potassium hydroxide on phenol, and formed in these authors' method of estimating phenol (Abstr., 1890, 1473), is not a di-iodoiodosobenzene, $C_6H_3I_2\cdot OI$, but a mixture of 2 : 4 : 6-tri-iodophenol with the red substance obtained by Lautemann (*Annalen*, 1861, **120**, 309), and shown by Benzinger and Kämmerer (Abstr., 1878, 574) to be tetraiododiphenylenequinone.

Similarly, the substance obtained by Messinger and Vortmann from salicylic acid is a mixture of the same red substance with potassium 3 : 5-di-iodosalicylate. The extreme insolubility of Lautemann's red substance furnishes a means of estimating and separating salicylic acid. For example, a mixture of 0·1 gram of salicylic acid and 0·2 gram of cinnamic acid is dissolved in 50 c.c. of water and 1 gram of sodium carbonate. Excess of iodine is added, the whole heated on the water-bath for twenty minutes, and finally boiled for ten minutes under reflux, iodine being added from time to time to ensure excess being present. The latter is removed by sodium sulphite, and the precipitate collected on a Gooch crucible. The weight multiplied by 138/344 gives the weight of salicylic acid.

Lautemann's red substance is produced by the action of iodine on a solution of 2 : 4 : 6-tri-iodophenol in sodium carbonate.

J. C. C.

Estimation of Orcinol in Orchella "Weed." HENRY EDGAR WATT (*J. Soc. Chem. Ind.*, 1908, **27**, 612).—The following method of estimating orcinol in Orchella weed (the name usually given to the lichen *Rocella tinctoria*) is given. Two grams of the powdered lichen are mixed in a mortar with 2 grams of sodium carbonate, and water is then added gradually until the mixture has a volume of 100 c.c. After being stirred occasionally for twenty minutes, the mixture is poured on a filter, and 50 c.c. of the filtrate are treated with an excess of standardised sodium hypochlorite solution. An excess of $N/10$ arsenious acid solution is immediately added, and the excess is titrated back with sodium hypochlorite solution, using as indicator starch-iodide solution acidified with acetic acid. The sodium hypochlorite solution must be standardised on pure orcinol. Four samples of orchella weed from the Seychelles were found to contain 11·5%, 1·6%, 8·8%, and 9·3% of orcinol respectively. In addition to the instantaneous reaction between orcinol and sodium hypochlorite on which the above method is based, a secondary and slower reaction appears to take place, and is not completed within twenty-four hours. W. P. S.

Estimation of Sugar. IVAR BANG (*Biochem. Zeitsch.*, 1908, **11**, 538—540).—Further details of the author's method are given, and Jessen-Hansen's remarks on the theory of the reaction criticised.

W. D. H.

Detection of Dextrose in Urine. ANDREAS OTTO (*Pharm. Weekblad*, 1908, **45**, 809—813).—Kowarsky's phenylhydrazine test may be recommended, but the precipitate should be recrystallised from alcohol in order to obtain the typical crystalline form of the glucosazone; a slight excess of acetic acid does not influence the result. A rapid crystallisation does not affect the nature or the size of the crystals. Two minutes boiling with the reagent is not necessary, although desirable; addition of sodium chloride is not always necessary. The reaction with alkaline bismuth solution (Nylander's test) is accelerated and rendered more delicate by adding a few drops of platinic chloride, but attempts to make this a quantitative process by measuring the volume of the precipitate utterly failed, although there is no doubt as to the complete elimination of the dextrose. The addition of platinic chloride is particularly of service if the phosphates have not been removed previously.

The ordinary Fehling test for sugar is not influenced by platinic chloride. L. DE K.

Detection of Sucrose. M. EMMANUEL POZZI-ESCOT (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **25**, 1078).—A portion of the solution under examination is placed in a test-tube, and about 10 c.c. of concentrated sulphuric acid are then introduced, the test-tube being inclined so that the two liquids do not mix. If sucrose is present, a coloured ring appears at the junction of the liquids; the ring is red below and yellow above. The test will detect the presence of 0·00005 gram of sucrose. The reaction is also given by other carbohydrates, but it is most sensitive in the case of sucrose. W. P. S.

Detection of Glycuronic Acid by B. Tollens' Method in Human Urine. KARL TOLLENS (*Zeitsch. physiol. Chem.*, 1908, **56**, 115—116. Compare B. Tollens, this vol., ii, 639).—To 5 c.c. of urine, 0·5 c.c. of a 1% alcoholic solution of naphtharesorcinol and 5 c.c. of hydrochloric acid (D 1·19) are added; the solution is boiled for one minute over a small flame, left for four minutes, cooled, and extracted with ether. When glycuronic acid is present, the ether is coloured intensely blue, and when examined spectroscopically, shows a band near the sodium line. G. B.

Estimation of Tartaric Acid in Argol and Wine Lees. M. EMMANUEL POZZI-ESCOT (*Compt. rend.*, 1908, **146**, 1031—1032; *Ann. chim. anal.*, 1908, **13**, 266—269; *Bull. Soc. chim. Belg.*, 1908, **22**, 218—221; *Bull. Assoc. chim. Sucr. Dist.*, 1908, **25**, 964—967). —The method proposed depends on the insolubility of barium tartrate in alcohol, and on the solubility of barium bromide in this medium. A weighed quantity of about 1 gram of the sample is treated with an excess of potassium carbonate solution, and the mixture is boiled and diluted to a volume of 100 c.c. Twenty-five c.c. of this solution are acidified with hydrochloric acid, boiled to remove carbon dioxide, and then rendered alkaline with ammonia. Forty c.c. of $N/10$ alcoholic solution of barium bromide and about 75 c.c. of 95% alcohol are added, the mixture is stirred, and the precipitate, consisting of barium tartrate, is collected on a filter and washed with alcohol. The precipitate may then be converted into barium sulphate and weighed as such, the tartrate being calculated from the weight of sulphate found, or the excess of barium bromide may be estimated in the filtrate. For this purpose, the filtrate is diluted with water, ammonium oxalate is added, the barium oxalate is collected on a filter, washed with dilute ammonia, then decomposed with hot dilute sulphuric acid, and the oxalic acid in the solution titrated with potassium permanganate solution. The difference between the quantity of barium bromide added and that found as oxalate in the filtrate is equivalent to the tartaric acid in the sample. W. P. S.

Viscosity and Lubrication. CHARLES F. MABERY and J. HOWARD MATHEWS (*J. Amer. Chem. Soc.*, 1908, 30, 992—1001).—The viscosity of lubricating oils is usually regarded as a standard of quality, but probably does not afford a trustworthy indication of the comparative durability of oils differing widely in composition. If the viscosity constant is supplemented by chemical data and frictional durability tests, it may no doubt be depended on as giving accurate information for commercial purposes. A large number of hydrocarbons obtained by the fractional distillation of petroleum have been examined, and a series of frictional tests have been carried out with them in comparison with castor, sperm, and rape oils.

The lubricating value depends on the temperature reached during the frictional test, the degree of friction, and the time for which the oil continues to lubricate. The durability of the individual hydrocarbons increases with decrease in hydrogen, and in a similar ratio to the increase in specific viscosity. A hydrocarbon of the series C_nH_{2n-4} was found to be more efficient in reducing friction than castor, sperm, or rape oil. It was equal to sperm oil in temperature and coefficient of friction, and superior to castor and rape oils in durability.

With regard to the comparative value of the various series of hydrocarbons in petroleum from which lubricating oils are prepared, those of the C_nH_{2n+2} series have a low lubricating value. Lubricating oils from Pennsylvania petroleum consist chiefly of the C_nH_{2n} and C_nH_{2n-2} series, whilst those from the heavier oils are composed largely of hydrocarbons of the C_nH_{2n-2} and C_nH_{2n-4} series.

Comparative examination of distillates from South American and Pennsylvania petroleums has shown that neither sp. gr. nor b. p. can be depended on as indicating the lubricating value unless the source of the oil is known.

Nothing is at present known as to the constitution of the series of hydrocarbons in lubricating oils. E. G.

Analysis of Hyposulphites and their Compounds with Formaldehyde. W. F. GREAVES (*J. Soc. Dyers*, 1908, 24, 195—196).—For the estimation of formaldehyde in the formaldehyde compound of sodium hyposulphite, the method described by Cross, in which the compound is heated with chromic acid, is recommended as being trustworthy. A Lunge's nitrometer is employed for measuring the carbon dioxide produced. The inner tube of a Lunge bottle is filled with 5 c.c. of cold saturated chromic acid solution, and 10 c.c. of a 10% solution of the compound under examination are placed in the part of the bottle surrounding the tube. The bottle is then connected with the nitrometer, the contents of the bottle are mixed and gently heated until the mixture just boils, the bottle is next cooled by placing it in cold water, and, at the end of one hour, the volume of the carbon dioxide is read off, the usual corrections for temperature, pressure, &c., being made. The method described by Knecht and Hibbert (Abstr., 1907, ii, 907) for the estimation of sodium hyposulphite can be applied to the analysis of hyposulphite compounds which are not decomposed by water. W. P. S.

Folin's Method for Separating Acetone and Acetoacetic Acid in Urine. T. Stuart Hart (*J. Biol. Chem.*, 1908, 4, 473—476. Compare Abstr., 1907, ii, 588).—Folin's method was found to be a valuable one. In cases where acetone is excreted, the amount is far more constant than that of acetoacetic acid. If the total amount of the two substances increases, the increase is largely due to the acetoacetic acid.
W. D. H.

Separation of Ammonia and Amines by means of Boiling Absolute Alcohol. Jean Bertheaume (*Compt. rend.*, 1908, **146**, 1215—1217; *J. Pharm. Chim.*, 1908, **28**, 8—13. Compare Jarry, Abstr., 1899, ii, 738; Brochet and Cambier, *Bull. Soc. chim.*, [iii], **13**, 533).—In order to determine the trustworthiness of the method of separating amine hydrochlorides by means of boiling absolute alcohol, the author has determined the solubilities of methylamine hydrochloride, ammonium chloride, and a mixture of the two in this solvent. The amine hydrochloride was prepared from bromoacetamide, and purified from ammonia by yellow mercuric oxide.

The quantities of the salts dissolved separately were determined by evaporation of the solutions and desiccation at 110°; in the case of the mixture of the two salts, François' method of analysis (Abstr., 1907, ii, 503) was employed. The values obtained were:

100	grams	absolute alcohol	at	82°	dissolve	23·01	grams	NH_3MeCl.
100	„	„	„	78·5	„	1·538	„	NH_4Cl.
100	„	„	„	0	„	0·778	„	NH_4Cl.
100	„	„	„	82	„	25·0 2·266	„ „	NH_3MeCl and NH_4Cl.
100	„	„	„	0	„	6·0 0·65	„ „	NH_3MeCl and NH_4Cl.

From these results, it is obvious that the solubility of each salt in boiling alcohol is increased in the presence of the other, that when a mixture of methylamine and ammonium hydrochlorides is extracted with boiling alcohol the two salts are dissolved in the proportion 11 : 1, and that on cooling to 0° the solution deposits 1·616 grams of ammonium chloride per 19 grams of methylamine hydrochloride, that is, a mixture containing 85% of the latter salt.

Employing François' method of analysis, the author finds (1) that if a saturated aqueous solution of pure methylamine hydrochloride is saturated with ammonium chloride at 15°, the product deposited on evaporation contains 9·2% of the latter salt; (2) that the crystals first deposited by a boiling alcoholic solution of Brochet and Cambier's crude methylamine hydrochloride contain 10·8% of ammonium chloride, and (3) that a saturated solution of ammonium and methylamine hydrochlorides in boiling absolute alcohol deposits, on cooling, crystals containing 8·5% of ammonium chloride.

These results are contrary to the general opinion that ammonium chloride is insoluble in saturated aqueous or alcoholic solutions of methylamine hydrochloride.

The conclusion is drawn that the method of separation is of very little use. E. H.

A Rapid and Delicate Method of Detecting Bile-pigments in Urine. WILLIAM MACADIE (*Pharm. J.*, 1908, [iv], 26, 686).—A modification of Gmelin's test. The urate precipitate, produced by adding a saturated solution of calcium chloride to the faintly acid urine, contains the bile-pigments; it is dissolved in a mixture of 1 part of hydrochloric acid (D 1·16) and 3 parts of alcohol, and while still in the centrifuge-tube, 5—6 drops of nitric acid, D 1·42, are added. G. B.

Proposed Method for the Routine Valuation of Diastase Preparations. WILLIAM A. JOHNSON (*J. Amer. Chem. Soc.*, 1908, 30, 798—805).—Commercial potato-starch is washed, pressed dry, and dried gradually finally at 80°. The remaining water, generally about 10%, is then estimated. Other starches should not be employed. A quantity corresponding with 20 grams of anhydrous starch is then stirred with 100 c.c. of water, and poured into a flask containing 800 c.c. of boiling water; the boiling is continued for ten minutes, and hot water is added up to 1000 grams.

Fifty grams of the starch solution are weighed out into a series of flasks kept at 40°. To each are added increasing portions of the diastase solution (for instance, liquid malt ten times diluted). After ten minutes each bottle is tested for free starch with dilute iodine solution. This then gives an idea of the strength of the diastase product, as it shows how much is wanted to convert the starch into dextrin and sugar in a given time. The operation is then repeated, using double the quantities of starch solution and diastase solution. As a check, the sugar formed may be estimated. L. DE K.

Colorimetric Method Applicable to both Peptic and Tryptic Enzymes. HERBERT E. ROAF (*Bio-Chem. J.*, 1908, 3, 188—192).—Grützner's method of estimating the rate of proteolysis by the amount of carmin liberated from fibrin stained with that pigment has the disadvantage that it is only applicable to enzymes which, like pepsin, act in an acid medium; if used for trypsin, the dye is liberated by the alkali employed. Congo-red may be substituted for carmin, and fibrin stained with it may be used for both peptic and tryptic ferments. W. D. H.

Ferments and Anti-ferments. VII. Detection of Trypsin. MARTIN JACOBY (*Biochem. Zeitsch.*, 1908, 10, 229—231. Compare Abstr., this vol., i, 236).—A solution of ricin or a suspension of edestin remains cloudy in the absence of trypsin, and becomes clear when trypsin is present in an alkaline medium. W. D. H.

Süchting's Method for Estimating Acidity of Soils. A. J. VAN SCHERMBEEK (*J. pr. Chem.*, 1908, [ii], 77, 489—497).—In Tacke's method for estimating soil acidity (Abstr., 1908, ii, 103), it is assumed that no acid is produced during the four hours required for the determination. It is pointed out that, whilst under natural conditions the production of acids in the soil is checked when the acidity reaches a certain limit, the soil water is greatly diluted in the process referred to, and conditions are thus produced which are favourable to increased decomposition of the organic matter; the error is further increased by addition of calcium carbonate. Süchting's modification (this vol., ii, 231) has the advantage that the time required is reduced to about half; nevertheless, it yields results which may be far too high. A peaty sand, for example, showed an amount of acid corresponding with 1·44% HCl in the soil water, which is fifty to sixty times the amount in which it is possible for roots to live.

Correct results can only be obtained under conditions of sterilisation.
N. H. J. M.

Separation of Clay in the Estimation of Humus. C. A. Mooers and H. H. Hampton (*J. Amer. Chem. Soc.*, 1908, 30, 805—807).—Determinations of the humus by evaporating the ammoniacal extract to dryness on a water-bath, so as to coagulate the clay, redissolving in 4% ammonia, and filtering, shows that this method gives more uniform results than direct filtration through a Pasteur-Chamberland filter, which gives low results, chiefly owing to loss of humus in the filter. Peter and Averitt's method (*Kentucky Stat. Bul.*, No. 126, 63—126), in which a factor is employed for correcting for loss in the clayey residue, was also found to be unsatisfactory; the results were not concordant, and the factor (10%) too low for the soils examined.

A number of determinations of humus in soils limed three years previously, and in the unlimed soils, showed that the small differences due to lime can be detected by the evaporation method described above.
N. H. J. M.

The Action of Heat on the Lecithin-Phosphoric Acid Contained in Pastry. W. Ludwig (*Zeitsch. Nahr. Genussm.*, 1908, 15, 668—680).—It is shown that a considerable decrease in the amount of lecithin-phosphoric acid present in pastry takes place when the latter is heated for some time at a temperature of 102°. The loss is particularly marked in samples containing but little egg-material, and may amount to as much as 40%, calculated on the quantity present before the heating. The decrease is not due to loss of volatile phosphorus compounds, but to a portion of the lecithin being rendered insoluble in the solvents employed in the estimation of the lecithin-phosphoric acid. The total amount of phosphoric acid is the same after as before the heating. A small decrease in the amount of lecithin-phosphoric acid was also noticed when the pastry was kept for a few months. The author finds that practically the whole of the lecithin-phosphoric acid may be obtained in solution by boiling the pastry three times with absolute alcohol, the boiling being continued for twenty minutes each time.
W. P. S.

General and Physical Chemistry.

Magnetic and Electric Double Refraction of Nitrobenzene. Variation with Wave-length. A. COTTON and HENRI MOUTON (*Compt. rend.*, 1908, **147**, 193—195. Compare Abstr., 1907, ii, 727; this vol., ii, 2).—The differences between the ordinary and extraordinary indices of refraction of nitrobenzene in the magnetic field increase regularly when the wave-length of the light diminishes. Measurements have been made with the yellow, green, and indigo mercury lines, and with the *C* and *F* lines of hydrogen. Kerr's phenomenon has been studied in the case of pure nitrobenzene, using small differences of potential, and it is found that the dispersion is the same in the case of electric as in the case of magnetic double refraction; the temperature-coefficient is also approximately the same for each. The two phenomena therefore appear to have a common origin, and this may be sought in molecular orientation. W. O. W.

Spectrum of the Discharge from a Glowing Lime Cathode in Mercury Vapour. F. HORTON (*Proc. Camb. Phil. Soc.*, 1908, **14**, 501—507).—The spectrum of the discharge between an electrically heated Wehnelt cathode and an aluminium anode exhibits five new lines, which are shown to be due to mercury. The wave-lengths of the lines are 6912, 6715, 6232, 6121, and 6070. The fact that these have not been described previously is supposed to be due to their absence from the ordinary arc or spark spectrum. H. M. D.

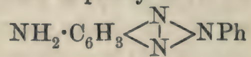
Spectra of the Calcium Flame. GUSTAVE A. HEMSALECH and CHARLES DE WATTEVILLE (*Compt. rend.*, 1908, **147**, 188—190).—A spectrophotographic study of the calcium flame obtained by the apparatus previously described (this vol., ii, 336). The spectra are considerably richer in lines than the flame spectra hitherto obtained. A table is given showing the wave-lengths of the lines and also their relative intensities when the spark is used in conjunction with air-gas, air-hydrogen, oxygen-coal gas, and oxyhydrogen flames, and also when the de Watteville pulverisation method with an air-gas flame is employed. W. O. W.

Absorption Spectra of some Compounds obtained from Pyridine and Collidine. JOHN E. PURVIS (*Proc. Camb. Phil. Soc.*, 1908, **14**, 435—440. Compare Baker and Baly, Trans., 1907, **91**, 1122).—The absorption band of 3 : 5-dichloropyridine is found to be displaced towards the red end of the spectrum when compared with that of pyridine. The amount of the displacement and the persistence of the band are, however, smaller than has been found in the case of 3 : 4 : 5-trichloropyridine. These effects are in agreement with previous observations relating to the influence of the introduction of chlorine into the pyridine nucleus.

The absorption band of collidine hydrochloride is also displaced towards the red end relatively to that of the free base, and the persistence of the band is increased by union with hydrochloric acid.

Observations have also been made with the heptachlorolutidine obtained by Sell and Foster from the enneachlorocollidine previously examined. Compared with that of the latter substance, the absorption band of heptachlorolutidine is displaced towards the red, and its persistence is considerably greater. H. M. D.

Change of the Colour of Fluorescence with the Solvent. HEINRICH LEY and K. VON ENGELHARDT (*Ber.*, 1908, **41**, 2509—2516).—It has been observed repeatedly that the colour of fluorescence depends on the nature of the solvent in which the fluorescent substance is dissolved. Kehrmann and Messinger (Abstr., 1892, 889) and Kauffmann and Beisswenger's investigations (Abstr., 1905, ii, 131) point to a relation between the colour of fluorescence and the dielectric constant of the solvent, whilst Stark (Abstr., 1907, ii, 147) draws attention to the relation of fluorescence to selective absorption. The present authors have now studied the changes in the absorption spectra of substances with varying fluorescence when dissolved in various solvents, the absorption curves being carried into the ultra-violet. As objects of study were chosen 5-amino-2-phenyl-2 : 1 : 3-benzotriazole,



$$NH_2\cdot C_6H_3{<}\overset{N}{\underset{N}{|}}{>}NPh$$

(Kehrmann and Messinger, *loc. cit.*), and dimethylnaphtheurhodine (Kauffmann and Beisswenger, *loc. cit.*) in methyl-alcoholic, ethyl-alcoholic, ethereal, chloroform, ethyl acetate, and carbon disulphide solutions. The results are tabulated and expressed in curves.

It is found that with the benzotriazole, the fluorescence changes from bluish-green through blue to bluish-violet, and the absorption is shifted towards the ultra-violet when the base is dissolved in alcohol, ether, and chloroform in the order named. That the solution in carbon disulphide is not fluorescent is to be ascribed to the formation of an additive *compound*, in agreement with which it is found that the solution in carbon disulphide is stable towards light, whereas the solutions in other solvents, especially in chloroform, are rapidly decomposed on exposure to light. The fluorescence is weakened by addition of acids, but disappears only in presence of an excess of hydrochloric acid; this change also is expressed in the absorption curve. It is probable that the hydrochloride fluoresces in the ultra-violet.

With the eurhodine base, also, the colour of the fluorescence changes with the shifting of the absorption towards the ultra-violet, but in the order of solvents: alcohol, chloroform, ethyl acetate, ether, from reddish-yellow through yellowish-green to yellow. G. Y.

Fluorescence and Photo-electric Sensitiveness of Organic Substances. JOHANNES STARK and W. STEUBING (*Physikal. Zeitsch.*, 1908, **9**, 481—495. Compare Abstr., 1907, ii, 147, 417; this vol., ii, 138).—The authors have made experiments on a large number of substances to ascertain the relationship between fluorescence, on the one hand, and the nature of the banded absorption spectrum and the photo-electric effect, on the other.

Benzene and derivatives of it containing no other chromophoric group exhibit fluorescence bands which, like the corresponding absorption bands, decrease in intensity with increasing wave-length. The fluorescence spectrum of benzene is situated in the region of smallest wave-lengths, substitution of one or more hydrogen atoms leading to a displacement of the spectrum towards greater wave-lengths. The same phenomenon is met with in the case of condensed or coupled ring compounds. The displacement produced by successive substitution shows a gradual decrease. Of the various substituting groups investigated, the methyl group produces the least displacement and the amino-group the greatest. The fluorescence spectrum of benzene, naphthalene, anthracene, phenanthrene, and certain other aromatic hydrocarbons consists of several distinct bands, but if hydrogen in the ring is substituted by another element or group, or if two benzene rings are coupled by other atoms than carbon and hydrogen, a continuous spectrum is obtained. Substances containing a chromophoric group, but not a benzene ring, do not exhibit fluorescence.

As a result of the examination of the photo-electric properties, the conclusion is drawn that substances which fluoresce are also photo-electrically active. The greater the photo-electric effect the more intense is the fluorescence. Quinine sulphate is an exception, and it is suggested that this is due to a difference in the constitution of the solid and the dissolved substance.

The fluorescence of benzene derivatives containing another chromophoric group has been examined. The behaviour of these can be anticipated from that of the two simpler classes of substances.

An explanation of the phenomena of fluorescence and of photo-electric activity is given in terms of the electronic theory discussed in the authors' previous papers. H. M. D.

A Case of Anomalous Rotatory Dispersion. Application of Measurements of Rotatory Dispersion to the Study of the Composition of Oil of Turpentine. EUGÈNE DARMOIS (*Compt. rend.*, 1908, **147**, 195—197).—French lævorotatory turpentine has practically constant properties, and probably contains *l*-pinene. Other oils are usually dextrorotatory, and probably contain *d*-pinene. The rotatory dispersion of certain lævo- and dextro-oils has been studied, and it is found that the dispersion is normal, but varies with the oil examined. Certain mixtures of dextro- and lævo-oils, however, exhibit anomalous dispersion, the results not being in accordance with those calculated from Biot's law of mixtures. These mixtures can, moreover, be produced by distillation of any dextro-oil, by stopping the operation at the right point. The conclusion is drawn that the two dextro- and lævo-oils are not chemically homogeneous. Crystallisable *l*-pinene has been isolated from the lævo-oil. The dextro-oil probably contains *d*-pinene together with an unknown substance having less dispersive power than *l*-pinene. W. O. W.

Triboluminescence of Racemic Compounds. DÉSIRÉ GERNEZ (*Compt. rend.*, 1908, **147**, 11—15. Compare Tschugaeff, Abstr., 1905, ii, 132).—A number of *d*- and *l*-tartrates and the corresponding racemates have been examined with the object of testing Tschugaeff's theory, that when the two active forms are triboluminescent the racemic compound is not. In confirmation of the theory, the author finds that *l*-tartaric acid, like the dextro-modification, is triboluminescent and racemic acid is not. Dextro- and lævo-potassium tartrates and potassium racemate, and *d*- and *l*-ammonium tartrates and ammonium racemate, obey the rule, as also does the double racemate of sodium and potassium, the constituents of which are both triboluminescent. Contrary to Tschugaeff's statement, acid potassium racemate is triboluminescent as well as the acid potassium tartrates.

The following substances are all triboluminescent and contrary to Tschugaeff's theory: the normal tartrates and racemates of rubidium, sodium, and thallium; the acid tartrates and racemates of ammonium, potassium, rubidium, sodium, and thallium, and the double racemates of ammonium-lithium, antimonyl-potassium, cæsium-lithium, lithium-potassium, lithium-rubidium, lithium-sodium, lithium-thallium, rubidium-sodium, sodium-thallium. Lithium racemate is triboluminescent, but the lithium tartrates could only be obtained in a non-crystalline condition, and appeared to give no light when crushed.

The *d*- and *l*-tartrates and the racemates of quinine, strychnine, and brucine, and the acid *d*- and *l*-tartrates and acid racemates of cinchonine, strychnine, and brucine, are all crystalline substances exhibiting triboluminescence.

There are only six authentic cases in favour of Tschugaeff's rule as compared with a large number in opposition to it. No general relation can be detected between molecular symmetry and triboluminescence. R. J. C.

Thermodynamic Treatment of Photochemical Processes. FRITZ WEIGERT (*Zeitsch. physikal. Chem.*, 1908, **63**, 458—466).—Various formulæ are deduced by the author, and their bearing on the experimental results obtained by Luther and Weigert (Abstr., 1905, ii, 785) are discussed. He reaches the result that in the system anthracene–dianthracene the energy which is chemically utilised in unit time is in all cases practically proportional to the light absorbed by the anthracene. If this is accepted, then it is possible on a thermodynamic basis alone to interpret all the experimental results observed by Luther and Weigert. The electrochemical theory recently propounded by Byk (this vol., ii, 339) appears to be unnecessary. J. C. P.

Emission of Electricity from the Induced Activity of Radium. WILLIAM DUANE (*Amer. J. Sci.*, 1901, [iv], **26**, 1—13).—The rate of decay of the induced activity of radium has been investigated by measurements of the quantity of electricity carried by the α- and β-rays instead of the ions produced by these. The induced activity was deposited on the surface of a small metallic cylinder, which, during the electrical measurements, was supported co-axially inside a tube of the same metal in such a way that the distance between the outer surface of the cylinder and the inner surface of the tube only amounted to 0·44 mm. The current flow between the cylinder and the tube was measured by means of a quadrant electrometer.

The decay curves obtained in this way do not coincide with the curves corresponding with the diminution of the ionisation, and this is attributed to the emission of negative rays by radium-*B*. From the variation of the rate of discharge with the time, the conclusion is drawn that the same quantity of electricity is discharged when radium-*B* changes into radium-*C* as when radium-*C* changes into radium-*D*.

In a magnetic field parallel to the active surface, or an electrical field normal to the surface, the rate of discharge is altered; the magnitude of the observed effects is what would be expected if the charge were carried by electrons moving with velocities, normal to the active surface, of, or less than, 4×10^8 cms. per second.

The number of ions produced by the α-rays in air is less than 9000 times, and probably less than 3600 times the number of β-particles emitted by the active deposit in the same time. Assuming that each α-particle from radium-*C* produces 180,000 ions, it follows that at least 20, and probably more than 50, electrons are emitted from an active (brass) surface for every α-particle which is expelled from radium-*C*.

The experiments also show that the ionisation caused by radium-*B* and radium-*C* in the air in the immediate neighbourhood of the active surface is approximately the same. H. M. D.

Coefficient of Absorption of Radioactive Emanations in Different Liquids. José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, 6, 319—320).—A claim for priority (compare Kofler, this vol., ii, 80). W. A. D.

Photographic Impressions Produced by Radium Emanation. José Muñoz del Castillo and Faustino Díaz de Rada (*Anal. Fis. Quim.*, 1908, 6, 322—323).—Radioactive solutions having an activity of 2,100,000 volts per hour per litre produce very good radiographs with an exposure of thirty hours; solutions with an activity of 2100 volts per hour per litre in the same circumstances do not affect the plate. W. A. D.

Radioactivity of Swedish Spring Waters. Hjalmar Sjögren and Naima Sahlbom (*Arkiv. Kem. Min. Geol.*, 1908, 3, i, No. 2, 1—28).—The authors have examined about sixty spring waters from central and southern Sweden, and find in all cases evidence of the presence of a radioactive emanation. The samples of sea-water examined were found to be inactive. The degree of activity of a spring water depends on the chemical character and quantity of the water and on the depth of the spring. In some waters the emanation is found to be more abundant in winter than in summer. A close connexion exists between the radioactivity and geological character of a well, water from the granite showing the highest and that from sedimentary rocks the lowest activity. In all cases, the radioactivity observed was found to correspond with that of radium. The ochre deposited by some of the springs exhibits slight radioactivity, but the mud deposits are quite inactive. T. H. P.

Radioactivity of the Waters of Lerez. José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, 6, 237—242).—An investigation of the rate of decay of the radioactivity of the highly active waters of Lerez (compare Abstr., 1907, ii, 218). The initial activity probably exceeds 10,000 volts per hour per litre, and diminishes according to an exponential equation similar to that characteristic of radium; after about fifty days, however, a nearly constant residual radioactivity of about 20 volts is reached. It is probable that the radium emanation is responsible for the greater part of the radioactivity of these waters, but some other active substance is also present. W. A. D.

Radioactivity of Waters of Agaete (Canary Islands). Faustino Díaz de Rada (*Anal. Fis. Quim.*, 1908, 6, 242—243).—The chalybeate water of the thermal springs of Agaete has a temperature of 25° and is decidedly radioactive, one sample having an activity of 8·9 volts per hour per litre. W. A. D.

Radioactivity of Water from Cucho. José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, 6, 350).—The water of the San Roque spring, in the valley east of Cucho, province of Burgos, contains hydrogen sulphide, and has a temperature of 15° and an initial activity of about 74 volts per hour per litre. W. A. D.

Radioactivity of Mud from the Baths of Fitero Viejo. Faustino Díaz de Rada (*Anal. Fis. Quim.*, 1908, 6, 344—350).—From the character of the radioactivity of the mud, it is concluded that radium is present partly in a form soluble in hydrochloric acid and partly in an insoluble form. Thorium is entirely absent, but actinium may be present. W. A. D.

Radioactivity of Potassium and other Alkali Metals. J. C. McLennan and W. T. Kennedy (*Physikal. Zeitsch.*, 1908, 9, 510—512.* Compare Abstr., 1907, ii, 217, 597).—The radioactivity of a large number of potassium salts and of certain salts of sodium, ammonium, lithium, rubidium, and calcium has been examined by measuring the saturation current produced by the various salts when distributed in thin uniform layers on the base of an ionisation chamber. All the potassium salts and metallic potassium were found to be radioactive, but when the activities are divided by the percentages of potassium in the various compounds, numbers are obtained which vary in the ratio of one to thirty-three. The author considers that this precludes the possibility that the radioactivity is a normal property of the potassium atom. With the exception of one sample of rock salt out of three examined, all the sodium salts and metallic sodium were found to be inactive. Ammonium chloride was found to be slightly active, rubidium alum and cæsium chloride still less so, and the other salts showed no trace of activity. The activity of the salts other than those of the alkali metals is supposed to be due to traces of radioactive impurities.

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* and *Phil. Mag.*, 1908, [vi], **16**, 377—395.

The activity of the potassium salts is unchanged on heating, and attempts to separate active impurities by electrolysis, recrystallisation, solution in ethyl ether, and by precipitation with ammonium carbonate gave no positive result. H. M. D.

Nature of the γ-Rays. JOSEPH J. THOMSON (*Proc. Camb. Phil. Soc.*, 1908, **14**, 540).—Of the two views which have been advanced as to the nature of γ-rays: (1) that they are pulses of electromagnetic disturbance propagated through the ether; (2) that they are electrical doublets travelling with great velocity and possessing energy and momentum, it is pointed out that these approximate closely if it is supposed that the electromagnetic disturbance is distributed, not uniformly, but in patches over the wave-front. According to the pulse theory, the velocity of propagation of the rays should be equal to that of light, which is the case according to available experimental data. Barkla's measurements of the polarisation of the secondary rays produced by the γ-rays are also in accord with the pulse theory. By means of these two factors, it is possible to differentiate between the two theories. H. M. D.

Velocity of Secondary Cathode Rays from Gases. JOSEPH J. THOMSON (*Proc. Camb. Phil. Soc.*, 1908, **14**, 541—545).—The blue pencil of cathode rays emanating from a Wehnelt cathode, on which the lime is confined to a small area, is surrounded by a blue haze. This is due to secondary rays produced by impact of the primary cathode rays against the gas molecules. If a piece of metal is inserted in the region occupied by the haze and the metal is negatively charged to a moderate potential, the negative particles of the haze are repelled and the metal is surrounded by a well-defined dark space. Experiments are described the object of which was to determine the difference of potential required to stop the negative particles. It is found that this potential difference is independent of the potential of the primary discharge, indicating that the energy of the secondary rays is independent of that of the primary rays. This result is in agreement with the view that the energy in the secondary rays is determined by the atoms emitting them. The energy of the secondary rays does not seem to vary much with the nature of the atoms emitting them, for air, hydrogen, and carbon dioxide give the same value, and this is very nearly equal to the value found by Füchtbauer for the secondary rays from metals.

From the potential difference required to stop the secondary rays, the velocity of these is calculated to be $3 \cdot 7 \times 10^8$ cms. per second.

H. M. D.

Positive Electrons. JEAN BECQUEREL (*Compt. rend.*, 1908, **147**, 121—124. Compare Abstr., 1907, ii, 421).—In order to justify the suggestion that several experiments are best explained by assuming the existence of free positive electrons, the author critically examines his results to see whether they are explainable on any other hypothesis.

In the modified Crookes tube previously described, the beam issuing through the hole in the principal cathode appears to be separated by a magnetic field into (1) strongly deviated cathode rays (negative electrons); (2) canal rays (positive ions), which, being presumably attracted by the cathode corpuscles, are slightly deviated in the same direction; (3) rays which are strongly deviated in the opposite direction. The last are supposed to consist of positive electrons.

The positive charges direct themselves towards a second cathode, which is ring-shaped, and having passed through, produce a phosphorescence on a disk of willemite, although they are no longer deviable by a magnetic field. This phosphorescence is not due to the canal rays, which have insufficient penetrating power to reach the willemite. If the willemite disk is brought near to the second cathode, a phosphorescent patch due to canal rays can be seen distinct from that due to positive electrons. The former patch is practically unaffected on bringing a magnet near the second cathode, whereas the latter is notably displaced. The phosphorescent spot due to positive electrons is in respect of position, intensity, and shape independent of the distance of the willemite from the second cathode. The spot due to canal rays, on the other hand, is scarcely perceptible unless the willemite is quite near the second cathode and is negatively charged. Alteration of the electric field by bringing the hand near the tube is sufficient to displace the canal rays, whilst the beam of positive electrons, being apparently not electrified, remains unaffected.

The positive deviable beam cannot consist of ions, because these would be attracted by the cathode stream in the opposite direction to that which the beam in question actually takes. The attraction would, however, be small, and as a matter of fact the canal rays are but slightly deviated along with the cathode stream.

The two images formed on the willemite are not due to canal rays going partly through the ring cathode and partly round it. In one vacuum tube in which this was possible, the canal rays produced a phosphorescent image of the ring cathode on the willemite, but the other, a strong phosphorescent spot, was always present as well.

The deviable ray cannot consist of positive ions of low velocity, since positive ions travelling with the same *E.M.F.* (the canal ions) are already present, and are hardly deviable. The fact that the beam in question, after passing through the second cathode, is apparently no longer electrified, suggests that it is a combination of positive ions with negative electrons. Righi, however, has shown (*Atti R. Accad. Lincei*, 1908, **17**, 87) that such systems would, in a magnetic field, be deviated parallel to the lines of force.

Having failed to explain the phenomena by any recognised form of radiation, the author was led to consider the deviable rays as positive electrons liberated by the action of cathode rays on canal rays. The mechanism by which positive electrons are liberated is still obscure.

Perhaps they are grouped at the centres of atoms, and are attracted out by the atmosphere of cathode corpuscles. The negative electrons may act like projectiles against the positive ions which constitute canal rays.

The rapidity with which positive electrons disappear when they emerge from the atmosphere of negative electrons is surprising. The beam beyond the second cathode must be a flux of neutral material formed when the positive electrons disappear. The positive electrons may then have re-combined with the gas in the tube, but if the isolation of two kinds of electrons can be supposed to constitute the complete disintegration of matter, a bolder hypothesis is permissible, namely, that positive electrons combine directly with negative electrons, giving rise, perhaps, to hydrogen, which always appears in a Crookes tube. R. J. C.

Ionised Gases. A. Blanc (*Compt. rend.*, 1908, **147**, 39—42).—The mobilities of positive and negative ions in mixtures of carbon dioxide with hydrogen or air in varying proportions have been measured by a modification of Rutherford's alternating magnetic field method. It is found that the curves representing the inverse of the mobility in terms of the partial pressure of one of the gases in the mixture are in all cases straight lines. An equation is deduced theoretically connecting the mass of an ion with its mobility and the molecular composition of the mixed gases. From this it follows that if the effect of collisions between ions and molecules can be neglected, the mass of an ion must be of the same order as the mass of a molecule.

A positive or negative ion produced in carbon dioxide and travelling into air assumes the ordinary velocity of an ion produced in air.

The author supposes that an ion consists of a cluster of molecules which are constantly interchanged with the molecules of the surrounding gas. A carbon dioxide ion entering air, speedily becomes transformed into an air ion. R. J. C.

Bose's Phenomenon and the Laws of Contact Electrification. Édouard Guillaume (*Compt. rend.*, 1908, **147**, 53—55. Compare Bose, *J. Physique*, 1902, iv, 1, 481).—The production of an *E.M.F.* when a metallic thread immersed in an electrolyte is sharply twisted and the appearance of fatigue in this phenomenon have been further investigated.

If the wire is perfectly clean and the electrolyte is without action on it, no *E.M.F.* can be obtained by twisting the metal. Metals like copper and zinc when immersed in the electrolyte become covered with a thin, grey film. In such cases, twisting the wire produces a potential difference which is independent of the direction, but proportional to the angle of torsion. A number of twists at short intervals produce a gradually diminishing electrification. If a metal which is not superficially attacked by the liquid is covered with a thin, porous film, the same effects can be produced. Thus silver may be coated with its iodide, and platinum with gelatin or a burnt on film of kaolin.

The phenomena can be explained by Perrin's rules of contact electrification (see following abstract), which enable the relative effects of various electrolytes to be calculated with considerable accuracy. R. J. C.

The Bose-Guillaume Phenomenon and Contact Electrification. Jean Perrin (*Compt. rend.*, 1908, **147**, 55—56).—The following explanation is given of the phenomena observed by Bose and by Guillaume (preceding abstract). When a wire covered with a thin, porous film is immersed in an electrolyte, the spongy sheath is electrified by contact along the whole of its enormous surface. The impregnating solution therefore contains an excess of ions of the opposite sign. When the wire is sharply twisted, the sheath is stretched, and a minute amount of the charged impregnating liquid is squeezed out into the external solution, leaving behind an excess of electricity of the opposite sign, which gives rise to a momentary *E.M.F.*

The extent and sign of the potential difference is determined by the nature of the contact electrification between the material of the film and the electrolyte. H^+ and OH^- ions produce strong positive and negative effects, but are paralysed by multivalent ions of opposite sign.

Electrification by torsion is analogous with electrification by filtration through a porous diaphragm. R. J. C.

Conduction of Electricity by Metals and Amalgams. Jenö Kinsky (*Zeitsch. Elektrochem.*, 1908, **14**, 406—410).—The experiments were intended to test the question whether positively-charged ions take any part in the transport of electricity through metals. Several copper and zinc cylinders with accurately-ground surfaces of contact were placed in contact and 5200 ampere hours passed through them, but no change in weight could be detected; iron and brass gave the same result. With silver and copper plates, no change of weight occurred, and the silver was quite free from copper both before and after the experiment. A large quantity of electricity was also passed through a tube containing homogeneous barium amalgam; after the experiment, the barium was found to be still quite evenly distributed throughout the tube. It appears, therefore, that positive ions take no part in the conduction of the current. T. E.

Relation between Current and Potential Difference in Solutions of Iodine in Potassium Iodide. Experiments with Bright Platinum Electrodes. Erich Brunner (*Zeitsch. physikal. Chem.*, 1908, **63**, 487—506. Compare Abstr., 1907, ii, 223).—The experiments have been carried out in the same way as previously described (*loc. cit.*). Except in the neighbourhood of the cathodic limiting current, the values obtained for the polarisation are, as a rule, only a few millivolts greater than those observed at platinised electrodes. The results obtained at the unplatinised electrodes may be expressed by the formula $\epsilon = \epsilon_0 + I(\omega_0 + q.\omega')$ (compare *loc. cit.*), where q varies between 1 and 8, mostly between 2 and 5; during one experiment, and generally also during a series of experiments made successively in different solutions, q is fairly constant.

It is possible that the excess of the polarisation observed at unplatinised electrodes over that found at platinised electrodes is due to a surface resistance caused by cathodic polarisation, a resistance which vanishes as rapidly as it is produced. The excess, as far as can be seen, has nothing to do with chemical polarisation. J. C. P.

Thermodynamic Calculation of Electromotive Forces. Franz Halla (*Zeitsch. Elektrochem.*, 1908, **14**, 411—414).—Nernst's theory of the relation between heat development and maximum work in reactions in condensed systems (Abstr., 1907, ii, 153) is tested for the case of the two reactions $2Ag + PbCl_2 = Pb + 2AgCl$ and $2Ag + Hg_2Cl_2 = 2Hg + 2AgCl$, using existing data. Satisfactory agreement is found between the requirements of the theory and the facts. T. E.

Discharge Potentials of the Ions in Solutions of Alkali Alkyloxides. Giacomo Carrara and Aldo Bringhenti (*Gazzetta*, 1908, **38**, i, 698—708).—The anode potential curves of solutions of sodium methoxide in methyl alcohol and sodium ethoxide in ethyl alcohol exhibit characteristic points at 0·32—0·34 volt, referred to the potential of the decinormal calomel electrode as zero. These values, which differ so little in the two cases that they cannot be differentiated, represent the discharge potentials of the ions (OMe) and (OEt). Similar close agreement exists between the heats of formation of the corresponding sodium salts, and it is probable that the tensions of electrolytic decomposition of these salts are also nearly equal in value. Another less sharply marked point is shown by the anode potential curves between 0·60 and 0·65 volt; it is possible that this corresponds with the discharge potential of anions of small quantities of aldehydes or acids formed by the oxidising action of the platinised platinum in presence of air. The corresponding cathode potential curves exhibit a common characteristic point at 1·22 volts, which represents that of the sodium ion. T. H. P.

Stability of the Alternating Arc; a Function of the Atomic Weight of the Metallic Electrodes. Charles E. Guye and A. Bron (*Compt. rend.*, 1908, **147**, 49—51).—It was shown in a recent paper (this vol., ii, 561) that the minimum potential required for a stable alternating arc largely depends on the period of extinction of the arc. This theory is now applied to elucidate the results of the authors' earlier researches on short metallic arcs.

Given the same current density, gap between electrodes, period of alternation, and air pressure, the voltage required to establish a stable arc increases regularly with the atomic weight of the electrodes. For example, with arcs 5 mm. long and current density 0·04 ampere per sq. centimetre of electrode, the voltages required are: carbon, 640; magnesium, 700; iron, 850; nickel, 850; copper, 870; silver, 900; cadmium, 725; platinum, 1000; gold, 1070. Cadmium is an exceptional case, as metallic vapour is largely produced, and the arc therefore requires an abnormally low voltage.

The period of alternation being 50, the arc is extinguished and re-lighted 100 times every second. The voltage required to re-light the arc must be the greater the more rapidly the electrodes cool at each extinction. The authors suppose that the cooling of the electrodes is for the most part the result of radiation, which is almost independent of the nature of the metal. Hence, as the specific heat is inversely as the atomic weight (Dulong and Petit), the higher the atomic weight the smaller the heat content of the electrodes, the quicker the cooling, and the higher the voltage required to re-light the arc.

It may also happen that electrons projected from the incandescent cathode have a velocity which is higher the higher the atomic weight. The two explanations are not mutually exclusive. R. J. C.

Chemical Reactions in a Magnetic Field. G. Berndt (*Physikal. Zeitsch.*, 1908, 9, 512—519).—The influence of a magnetic field on the heat development which accompanies the solution of iron in hydrochloric and sulphuric acids has been examined. The apparatus employed consisted of an electromagnet with square pole-pieces, between which a magnetic field of intensity equal to 3000 Gauss could be established. Two silvered Dewar vessels, packed in cotton-wool, were placed between the pole-pieces, and by means of a nickel-copper thermo-element the difference of temperature between the contents of the two vessels was read off at frequent intervals. One Dewar vessel served for the solution process, and the other acted as a blank to eliminate, as far as possible, temperature changes not due to the passage of iron into solution.

The estimated accuracy of the measurement of the difference between the heat of solution with and without a magnetic field is 1%, and to this extent the experimental data lead to the conclusion that a magnetic field has no influence on the amount of heat developed by the solution of iron in hydrochloric or sulphuric acids. It is shown that the differences previously obtained by Nicholls (Abstr., 1886, 668) are due to secondary disturbances, and that, although it has been shown by Duhem that the development of heat in a magnetic field should theoretically be less than without a field, the difference in question is too small to be experimentally measured.

One difference between the two processes is that the rate of solution in a magnetic field is smaller, and this is attributed to the fact that the iron particles do not respond so readily to the mechanical disturbances resulting from the evolution of gas. The protection of the iron from the action of the acid by the chloride formed may also contribute to the slower rate of solution in the magnetic field.

Experiments with zinc show that the heat change and the rate of solution are not influenced by a magnetic field. H. M. D.

Relation between Magnetic and Chemical Properties of Complex Ferric Salts. P. Pascal (*Compt. rend.*, 1908, **147**, 56—58).—The magnetic susceptibilities of a number of solutions of ferric compounds containing the same weight of iron per litre have been determined by the well-known U-tube method. It is found that as the condition of the iron is more and more removed from the ordinary (precipitable) ferric state, the solutions become more and more diamagnetic. The gradual addition of acid to ammoniacal ferric pyrophosphate is accompanied by a corresponding increase in paramagnetism, even before the solution has attained to the ordinary ferric colour. Excess of alkali, on the other hand, accentuates the diamagnetism of a ferripyrophosphate.

Ferrimetaphosphates and ferripyrophosphates exhibit the phenomenon of magnetic double refraction. R. J. C.

Orientation of Crystals by the Magnetic Field. Importance of Optical Properties of Mixed Liquids from the Point of View of Crystalline Symmetry. A. COTTON and HENRI MOUTON (*Compt. rend.*, 1908, **147**, 51—53. Compare Abstr., 1906, ii, 146; 1907, ii, 727).—The magnetic susceptibility of a crystal in various directions may be represented by an ellipsoid. Electrical and optical properties are also represented by ellipsoids. Although the relation between the ellipsoids cannot be generally stated, the elements of symmetry of the crystal belong to all three. Crystalline fragments suspended in a liquid in a metallic field will tend to set themselves with the long axis of their magnetic ellipsoid parallel to the lines of force. In an electric field, the long axis of the electric ellipsoid will set itself parallel to the lines of force. Crystals fall into two groups, according as the long axes of their magnetic and electric ellipsoids coincide or not. If, as in the case of the unaxial system, the two long axes do not coincide, suspended crystals will be completely oriented by the application of electric and magnetic fields at right angles, and the liquid with its suspended crystals will be isotropic in the direction of one of the fields. Some information concerning the crystallographic properties of microscopic crystals can thus be obtained.

The author combats the conclusion of Meslin (*Compt. rend.*, 1908, **146**, 1305) that the orientation of a suspended crystal by a magnetic field can alter with variation in the permeability of the suspending liquid. R. J. C.

Glass Thermostats for Higher Temperatures. H. W. FISCHER and O. BOBERTAG (*Zeitsch. Elektrochem.*, 1908, **14**, 375—376).—For temperatures above 100°, a large glass beaker containing 10 litres of paraffin oil is used; this is heated by a "cryptol" resistance enclosed in a glass tube. For temperatures below 100°, a glass vessel full of water is used; a stream of hot water, from a reservoir at constant head, flows into the vessel through a copper spiral heated by a gas flame, which is regulated by an ordinary regulator. T. E.

Density and Latent Heat of Fusion of Ice, and the Molecular Depression of the Freezing Point in Aqueous Solutions. W. A. ROTH (*Zeitsch. physikal. Chem.*, 1908, **63**, 441—446).—A critical review of the determinations of these constants recorded by various workers. The author considers the following to be the most probable values: for the density of ice at 0°, 0·9168; for the latent heat of fusion, 79·67 cal., the calorie being defined as the heat necessary to raise 1 gram of water from 15° to 16°; for the molecular depression of the freezing point, 1·858°. J. C. P.

Solidification Phenomena Exhibited by Inorganic Salts and Salt Mixtures. WILHELM PLATO (*Zeitsch. physikal. Chem.*, 1908, **63**, 447—457. Compare Abstr., 1906, ii, 521; 1907, ii, 239).—Further observations are recorded bearing on the author's method of calculating the latent heat of fusion from the special form of cooling curve described previously (*loc. cit.*). It appears that the formulæ based on the earlier results may be simplified. It is shown, also, that the latent heat of fusion may be deduced from the area enclosed by (1) the actual cooling curve, and (2) the curve that would be traced if no solidification took place. J. C. P.

Specific Heat of Barytes, Witherite, and Fused Lime. LATSCHENKO (*Compt. rend.*, 1908, **147**, 58—61).—The amounts of heat required to raise 3 to 7 grams of these substances from the room temperature to upwards of 1050° have been determined by the calorimetric method.

The specific heat of barytes increases regularly from 0·114 at 150° to 0·129 at 500°, remaining practically constant at higher temperatures.

Witherite undergoes a molecular transformation at about 800°, accompanied by a sudden increase of 19 calories per gram in the total heat of warming and a noteworthy change in the specific heat.

Values obtained with fused lime point to the existence of a molecular transformation at 405—410°, accompanied by an absorption of 5 calories per gram. Lime fused in the electric furnace gives good results only on the first occasion that it is plunged into the calorimeter water, as successive wettings and heatings break up the surface. Consistent results were obtained by the use of petroleum in the calorimeter. R. J. C.

Thermochemical Evidence for von Baeyer's Strain Theory. H. STANLEY REDGROVE (*Chem. News*, 1908, **98**, 25—27).—A theoretical paper on the thermal behaviour of the hydrocarbons, molecular heats of combustion of which have been determined by Thomsen and Strohmann, considered in the light of Baeyer's strain theory. Values for the thermal equivalent of double and treble linkings are deduced, and the thermal equivalent of strains in polymethylene compounds is found to be proportional to the angle of deviation of the carbon atoms. From thermal data, the conclusion is drawn that the molecular heat of formation found for ethylene oxide and that deduced are quite in accord with the strain theory; the heat equivalent of the molecular strain in this compound is given as 18·0 cals. J. V. E.

Explanation of the Viscosity Curve for Mixtures of Glycerol and Water. JOSÉ R. CARRACIDO (*Anal. Fis. Quim.*, 1908, **6**, 320—321).—The viscosity curve obtained by plotting the values given by Martínez-Strong (this vol., i, 307) shows a critical point between the concentrations 60% and 70% of glycerol, beyond which the viscosity increases very rapidly. Examined with the ultra-microscope, solutions containing less than 50% of glycerol do not show luminous points, and present the appearance of true solutions; solutions containing from 50% to 80% of glycerol show an increasing number of such points, and probably consist of a mixture of a true solution with colloidal glycerol in a state of pseudo-solution. Mixtures containing 90—100% of glycerol do not show points of light, and probably consist of liquid hydrogels which are completely homogeneous. W. A. D.

Osmotic Pressure of Dextrose Solutions at 10°. HARMON N. MORSE and W. W. HOLLAND (*Amer. Chem. J.*, 1908, **40**, 1—18. Compare this vol., ii, 671).—At 10°, the osmotic pressures of dextrose solutions are proportional to the concentrations, the maximum, minimum, and mean molecular pressures obtained for individual concentrations being 23·87, 23·70, and 23·80 atmospheres respectively. The excess of osmotic over gas pressure observed in the neighbourhood of 0° (*loc. cit.*) does not disappear at 10°, at which temperature the mean molecular gas pressure is 23·09 atmospheres. The mean value of the ratio of osmotic to gas pressure for $0·1N$ to $1·0N$ dextrose solutions at 10° is 1·031, the limiting values of the ratio being 1·035 and 1·027. The closer approximation of osmotic to gas pressure at 10° than at 0° is due more to the increase in gas pressure between these temperatures than to augmentation of osmotic pressure, the mean increases in molecular gas and osmotic pressures being 0·81 and 0·35 atmosphere respectively.

The following table summarises the results obtained up to the present time:

Temperature.	Mean ratio of osmotic to gas pressure.	Mean molecular osmotic pressure.
21·7—26·9°	0·993	24·01 atmosp.
10·0	1·031	23·80 ,,
0	1·052	23·45 ,,

T. H. P.

Explosive Crystallisation. FRANK E. WESTON (*Chem. News*, 1908, **98**, 27).—The author finds that when an aqueous solution of the compound formed by the combination of a sulphite with a thiosulphate is evaporated in a partial vacuum, a stage of concentration is reached when crystallisation may be accompanied by explosive violence. It seems probable in the case of the evaporation of some sulphites that crystallisation is suddenly induced on the surface with a consequent sudden increase in the vapour pressure of the surrounding liquid, which under the very low pressure existing causes the liquid to boil violently. J. V. E.

Theory of Dyeing. HUGO FISCHER (*Zeitsch. physikal. Chem.*, 1908, **63**, 480—486).—In criticising Freundlich and Losev's theory of adsorption (Abstr., 1907, ii, 534), the author argues against assuming the existence of internal surfaces in colloids. He maintains that the swelling of colloidal substances cannot be explained by reference to any sort of structure. The phenomena of swelling and of dye absorption alike are, in the opinion of the author, essentially solution phenomena. Experiments are quoted which support this view.

J. C. P.

Influence of the Medium on Brownian Motions. Victor Henri (*Compt. rend.*, 1908, **147**, 62—65).—Rubber latex is coagulated to a network of fine threads by addition of acids, but is agglutinated by alkalis to a mass of irregular granules without definite structure. Before coagulation sets in, the Brownian motion of the particles in the emulsion is retarded.

The author has made cinematographic photomicrographs of rubber latex diluted to 1 in 500 with water in presence of quantities of hydrochloric acid, acetic acid, sodium carbonate, carbamide, and alcohol too small to bring about coagulation. With alkali, the Brownian movements are twice as slow, and with acid nine times as slow, as in distilled water. Thus the average displacement of a particle in 1/20 second was $0·62\mu$ in water, $0·31\mu$ in $N/10$ sodium carbonate, and $0·07\mu$ in $N/32$ hydrochloric acid. $N/1000$ acetic acid produced the same effect as $N/32$ hydrochloric acid, although the former is a weaker coagulating agent.

The action cannot be attributed to the electrical influence of the ions, because alcohol produces an effect which is as intense as that of acid. On the other hand, carbamide, which does not coagulate the latex, also produces no change in the Brownian movement.

Measurements show that the granules absorb alkali somewhat, and acid very strongly. The author supposes that an adsorption zone containing molecules of the coagulating agent is formed round each granule, and that this surface combination is the cause of the slackening in the Brownian motion of the granules. R. J. C.

Osmotic Pressure and Brownian Motion. Jacques Duclaux (*Compt. rend.*, 1908, **147**, 131—134).—Colloidal solutions and very fine suspensions have been shown to possess an osmotic pressure. This has been explained on kinetic grounds, but the osmotic pressures calculated on the kinetic theory are systematically smaller than the experimental values, although of the same order. The recent work of Perrin (*Compt. rend.*, 1908, **146**, 967), which leads to an almost absolute agreement between experiment and the kinetic hypothesis, is criticised. The material employed by Perrin (namely, gamboge) is not entirely insoluble, so that in the emulsions which he prepared probably some 23% of the material was in solution. Furthermore, the insoluble particles were not conclusively shown to be of uniform size, and the method of enumerating them was questionable. Thus the kinetic theory does not explain the whole of the osmotic pressures. It is also inferior to the electrification theory of colloidal solutions in explaining many other properties, particularly coagulation,

The author supposes that the osmotic pressure of a colloidal solution is the same as that of an ordinary electrolytic solution containing the same number of electrons in the condition of free ions. It must be assumed that an ion exercises the same osmotic pressure whether free or as part of the layer on an electrified granule.

The charge can be recognised by the conductivity of the granules, that is, the difference in conductivity before and after filtering the colloidal solution through collodion. Knowing the velocity of the granules, their charge, the number of ions surrounding them and the corresponding osmotic pressures can be calculated.

The author has experimented with a true colloid, ferric hydroxide, and results calculated for osmotic pressure from the conductivity are of the same order, but somewhat smaller than the experimental values. The electrical theory gives results which are quite as good as those given by the kinetic theory, and is based on experiments made with a true colloidal solution instead of with a mere suspension, the properties of which in spite of several analogies are not the same. There is nothing incompatible in the two methods of treatment, however, if the kinetic theory is correctly regarded. R. J. C.

Ammonia Equilibrium. F. Jost (*Zeitsch. Elektrochem.*, 1908, 14, 373—375).—The author points out that the discrepancy between his measurements and those of Haber and Le Rossignol (this vol., ii, 362) is not very great at the lower temperatures. Up to 800° a difference of less than 40° in the measurement of temperature would account for it. The possible error of his own measurements is estimated at about 20°. At higher temperatures, the differences are larger, and it is suggested that in Haber's measurements the equilibrium may have been displaced towards the cooler part of the quartz tube. T. E.

Experimental and Thermodynamic Researches on Neutral Salt Action. Bohdan von Szyszkowski (*Zeitsch. physikal. Chem.*, 1908, 63, 421—440. Compare Abstr., 1907, ii, 238).—When carbon dioxide is passed through water containing ultramarine in suspension, hydrogen sulphide is liberated. The presence of neutral salts hinders this reaction, and there appears to be for each salt a concentration which is just sufficient to prevent any discoverable liberation of hydrogen sulphide. The author has determined these limiting concentrations in a number of cases, and regards the reciprocal of this concentration as a measure of the neutral salt action. It is found in this way that sodium salts exert a much stronger neutral salt action than potassium salts. When sodium salts alone are considered, it appears that the neutral salt action increases with the combining weight of the anion; this rule does not apply in the case of the potassium salts. As regards the comparative neutral salt action of sodium chloride and nitrate and potassium chloride and nitrate, the results of this investigation are in harmony with the author's earlier work (*loc. cit.*). There appears to be no immediate connexion between neutral salt action and the influence of the salts on gas solubility. A few experiments made with alcohol show that the general character of neutral salt action is manifest also in alcoholic solutions.

As a practical result of his work, the author advocates a method of testing the quality of a specimen of ultramarine. A sample of the best quality, suspended in a $1 \cdot 4N$ solution of sodium chloride and exposed to a fairly strong current of carbon dioxide, should not liberate any hydrogen sulphide.

The influence of a neutral salt, such as sodium chloride, on the behaviour of a weak electrolyte, such as carbonic acid, is discussed in general terms on a thermodynamic basis. J. C. P.

Velocity of the Reaction between Bromine and Benzaldehyde. WALTER HERZ and HERMANN DICK (*Ber.*, 1908, **41**, 2645—2648).—In connexion with experiments on the velocity of the addition of bromine to unsaturated substances in various solvents, the reaction $2PhCHO + Br_2 = PhCO_2 \cdot CHPhBr + HBr$ has been examined in chloroform, carbon disulphide, and carbon tetrachloride. The value of K, calculated for a bimolecular reaction, is almost the same and independent of the concentration in the first two solvents, but is about one thousand times as great in carbon tetrachloride.

C. S.

Inorganic Chemistry.

Hydrogen Persulphide. RUDOLF SCHENCK and V. FALCKE (*Ber.*, 1908, **41**, 2600—2603. Compare Bloch and Höhn, this vol., ii, 579, 580).—The authors have obtained the trisulphide H_2S_3 by distilling the crude polysulphide under diminished pressure. It is essential to blow steam through the glass vessels, and also to boil them in sulphuric acid, in order to remove the alkali from the surface, otherwise the polysulphide decomposes during distillation. It is a colourless, strongly refracting liquid, b. p. 43—50°/4·5 mm., D^{15} 1·496, and n_D over 1·70. Its odour resembles that of camphor, and of the product formed by the slow combustion of sulphur. The substance is extremely volatile, and dissolves in most organic solvents, but these solutions are unstable, with the exception of that in bromoform. Analyses and molecular weight determinations agree with the formula H_2S_3.

J. J. S.

The Polyiodide Molecule. PIO LAMI (*Boll. chim. farm.*, 1908, **47**, 435—441).—A theoretical paper. From the solubility of iodine in potassium iodide solutions of various strengths, and from the electrical conductivity of potassium iodide solutions, it is deduced that undissociated potassium polyiodide has the composition KII_2, and that it dissociates into the ions K and I′I.

No reference is made to the work of Jakowkin (Abstr., 1894, ii, 271; 1896, ii, 514; compare also Dawson, Trans., 1908, **93**, 1308).

G. B.

So-called Crystalline Boron. HEINRICH BILTZ (*Ber.*, 1908, **41**, 2634—2645).—Crystalline silicon can be obtained by Kühne's method (D.R.-P. 147871), but the directions for the preparation of crystalline boron do not give successful results. The author uses the following method. An intimate mixture of boron trioxide (50 grams), sulphur (75 grams), and aluminium (100 grams), or magnesium powder, is fired by a piece of magnesium ribbon. After the reaction, the fused mass is decomposed by water, the globules of aluminium separated, and treated with hydrochloric acid. The residual black, crystalline powder is treated successively with concentrated hydrochloric acid, hydrofluoric acid, and dilute hydrochloric acid for many days. When larger quantities of materials are to be used, the proportions must be altered, more aluminium and less sulphur being taken; the yield is smaller and the black crystals are not so large. The preparation is practically an individual substance, has D_4^{18} $2{\cdot}554 \pm 0{\cdot}005$ (by the floating method), and consists of monoclinic crystals [$a:b:c = 0{\cdot}7130:1:0{\cdot}7139$]. A complete analysis of the substance proves it to be *aluminium boride*, AlB_{12} (compare Hampe, this Journ., 1877, i, 273). It is identical with the black modification of crystalline boron obtained by Wöhler and Deville (*Annalen*, 1858, **105**, 68), the specimens of which, however, contained carbon as an impurity. The yellow, transparent crystals mentioned by these investigators have also been obtained by the preceding aluminothermic method, and will be discussed later. C. S.

Constitution of the Carbon Molecule. JOHN C. THOMLINSON (*Chem. News*, 1908, **98**, 37—38. Compare *ibid.*, 1906, **93**, 37).—A reply to the criticism (this vol., ii, 177) of Dewar's suggested formula for the constitution of the carbon molecule (*Chem. News*, 1908, **97**, 19). J. V. E.

Presence of Rare Gases in the Atmosphere at Different Heights. L. TEISSERENC DE BORT (*Compt. rend.*, 1908, **147**, 219—221).—Samples collected at Trappes from the upper regions of the atmosphere have been examined spectroscopically after removal of oxygen, nitrogen, and argon. The latter gas occurred in notable proportions. The samples collected up to a height of 10 kilometres contained both helium and neon, but helium was not detected in a sample obtained at 14 kilometres. W. O. W.

Acid Sulphates of Potassium. L. ARZALIER (*Compt. rend.*, 1908, **147**, 129—131).—On evaporation of a dilute solution containing molecular proportions of sulphuric acid and potassium sulphate, there are formed various acid salts, as described by Marignac, and also crystals of the composition $4K_2SO_4,3H_2SO_4,H_2O$, which, however, from their heat of solution do not appear to be a definite compound.

From concentrated sulphuric acid and normal potassium sulphate, the salts $K_2SO_4,3H_2SO_4,H_2O$ and $K_2SO_4,3H_2SO_4,3H_2O$ were prepared, which, when heated in an inert gas to 150°, yield the salt,

$$K_2SO_4,3H_2SO_4,$$

previously obtained by Schultz in an impure state. G. B.

Thioantimonates of Alkali Metals. I. A. D. DONK (*Chem. Weekblad*, 1908, **5**, 529—551).—From aqueous solutions, the following hydrated thioantimonates of sodium, potassium, ammonium, and lithium have been isolated: $Na_3SbS_4,9H_2O$; $K_3SbS_4,6H_2O$; $K_3SbS_4,5H_2O$; $K_3SbS_4,3H_2O$; $(NH_4)_3SbS_4,4H_2O$, and $Li_3SbS_4,10H_2O$. From aqueous-alcoholic solutions, the following have been isolated: $Na_3SbS_4,9H_2O$; $K_3SbS_4,5H_2O$; $K_3SbS_4,3H_2O$; $(NH_4)_3SbS_4,4H_2O$, and $Li_3SbS_4,10H_2O$. A. J. W.

Reaction between Ammonium Persulphate and Sodium Peroxide. R. KEMPF and ED. OEHLER (*Ber.*, 1908, **41**, 2576—2580. Compare Abstr., 1906, ii, 19, 25).—The fact that when an aqueous alkaline solution of ammonium persulphate is kept for some time the ammonia formed is quantitatively oxidised to nitric acid, whereas when silver peroxide is present the main oxidation product is nitrogen, is accounted for by the different velocities of the two reactions, the latter being much more rapid than the former. If the first reaction is accelerated by raising the temperature, nitrogen is also formed.

Ammonium persulphate and sodium peroxide react readily. When the dry substances are rubbed together in a mortar, the mixture explodes, producing thick fumes. The same result is obtained by heating the mixture, by passing a stream of carbon dioxide over it, or by the addition of a drop or two of water. The temperature at which the explosion occurs lies between 75° and 140°, and depends on the rate of heating and the amount of moisture present. The gases evolved consist of nitrogen and oxygen, but the proportions vary considerably in different experiments.

The mixture is not explosive when the peroxide is replaced by sodium hydroxide, or the ammonium persulphate replaced by ammonium sulphate, sodium persulphate, or a mixture of the two.

J. J. S.

Hydrates of Baryta and Strontia. ROBERT DE FORCRAND (*Compt. rend.*, 1908, **147**, 165—169. Compare this vol., ii, 155, 493).—The hydrate $SrO,9H_2O$ slowly loses water in a vacuum desiccator at 10° and, after a week, has the composition $SrO,2H_2O$. When left in a vacuum for a month, this is converted into SrO,H_2O. The dihydrate, the existence of which has hitherto been questioned, is also formed by heating $SrO,9H_2O$ for two hours at 45—50° in a stream of dry hydrogen; if the operation is carried out at 95°, the monohydrate is obtained in the same time, and this does not undergo further dehydration below 540°. At this temperature, however, water is lost until the product has a composition varying between $SrO,0\cdot22H_2O$ and $SrO,0\cdot06H_2O$. This has been mistaken by previous authors for anhydrous SrO, but it probably consists of a mixture of condensed hydrates. Anhydrous strontium oxide can only be obtained by heating this mixture to 850° for several hours.

The hydrate $BaO,9H_2O$ undergoes a somewhat similar series of changes when heated. The dihydrate, however, does not change into the monohydrate below 90—95°. BaO,H_2O has m. p. 325°, and does not lose water below 660°. When maintained at this temperature for several days, it becomes anhydrous; the change, however, is complete in two or three hours at 780°. There is no evidence for the existence of any compound intermediate between the monohydrate (hydroxide) and the oxide.

A table is given showing the heats of formation and heats of solution of the foregoing hydroxides and oxides in water, calculated from their heats of dissolution in dilute aqueous hydrogen chloride. The heat of solution for 1 gram molecule of SrO in 20 litres of water at 15° is 29·76 Cal., and not 30·8 Cal. as previously stated by the author (*loc. cit.*). From these data, the following conclusions are drawn: (1) The conversion of SrO,H_2O into SrO is more difficult than the conversion of BaO,H_2O into BaO. (2) $SrO,9H_2O$ and $BaO,9H_2O$ should dissociate at 142° and 152° respectively, whereas the actual temperatures of dissociation are 102° and 107°. The difference of 40—50° is due therefore to an endothermic condensation of the molecule on the formation of the dihydrate. A further endothermic condensation occurs on the conversion of the dihydrate into the monohydrate. (3) The oxides should be represented as $(SrO)_n$ and $(BaO)_{n'}$. W. O. W.

Action of Hydrochloric Acid on Manganese Dioxide. WILLIS B. HOLMES and E. V. MANUEL (*J. Amer. Chem. Soc.*, 1908, **30**, 1192—1193. Compare Abstr., 1907, ii, 873).—The authors cannot as yet confirm the existence of manganese tetrachloride, although they have some evidence of the formation of a compound richer in chlorine than the trichloride. L. DE K.

Colour and Composition of Guignet's Green. LOTHAR WÖHLER and W. BECKER (*Zeitsch. angew. Chem.*, 1908, **21**, 1600—1606).—Scheurer-Kestner's statement is confirmed (*Dingl. Polyt. J.*, 1865, **176**, 386), that the boron present in Guignet's green is without influence on the colour, and is present only as a remnant of the chromium borate formed primarily by fusion of potassium dichromate with boric acid. By employing ammonium, instead of potassium, dichromate, Guignet's green is readily obtained free from boron, and has then the composition, $Cr_4O_3(OH)_6$, ascribed to it by Scheurer-Kestner. The product obtained on heating potassium dichromate with an excess of boric acid has the composition $Cr_4O_3(B_4O_7)_3$.

Whilst Guignet's green has a vapour tension of 13 mm. at 75°, 16 mm. at 81°, and 26 mm. at 86°, the greyish-violet chromium hydroxide, which has the same composition, is found to have a vapour tension of only 2 mm., not increasing between 75° and 93·4°. This small vapour tension may result from the presence of moisture. These differences and the difference in colour of the two hydrates are ascribed to isomerism. The greyish-violet hydroxide is converted into its brilliant green isomeride on prolonged heating with water at 250°. G. Y.

Oxalate Reduction of Alkali Iridiochlorides. MARCEL DELÉPINE (*Compt. rend.*, 1908, **147**, 198).—A reply to Vèzes' claim to priority (this vol., ii, 703). W. O. W.

Mineralogical Chemistry.

Fumaroles of Etna. Boric Acid in the Fumaroles of Vesuvius. ALFRED LACROIX (*Compt. rend.*, 1908, **147**, 161—165).—The fumaroles of the recent (1908) eruption of Etna are of the same types as those of Vesuvius, but they are much less active; this is due to the short period of the eruption, and to the fact that the magma was poor in volatile materials. The types specially described are: (i) fumaroles depositing alkali chlorides; (ii) those emitting hydrogen chloride and depositing kremersite, &c., and (iii) those depositing ammonium chloride alone. The crusts of ammonium chloride were found to contain small amounts of fluorine, perhaps present as an alkali silicofluoride.

In one of the fumaroles of the 1906 eruption of Vesuvius, a small amount of sassolite (H_3BO_3) in crystalline scales was detected. This is rare at Vesuvius, but its presence is of importance in connexion with theories of pneumatolytic action. L. J. S.

Lavas of the Recent Eruption of Etna. ALFRED LACROIX (*Compt. rend.*, 1908, **147**, 99—103).—The various products of the 1908 eruption of Etna were examined petrographically and chemically. They closely resemble one another in chemical composition and in the porphyritic crystals (of basic plagioclase, little augite and magnetite, and very little olivine) which they contain. The rock of a lava flow (anal. I) which has cooled more slowly, and has consequently crystallised more completely, contains in its ground-mass microlites of augite and olivine with very little glass; this rock is a basalt, or, according to the French terminology, a labradorite. In a slightly scoriaceous product (anal. II) of eruptions of the Strombolian type, and in a highly scoriaceous bomb (anal. III) resulting by an explosion of the Hawaiian type, the ground-mass contains more glassy material. Anal. IV is of the ash which fell during the eruption:

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	TiO_2.	P_2O_5.	Loss on ignition.	Total.
I.	49·75	18·30	2·85	6·28	3·45	9·76	4·96	1·89	2·45	0·03	0·40	100·12
II.	49·71	18·40	1·93	6·96	3·45	9·80	5·13	1·72	2·58	0·02	0·00	99·70
III.	50·40	18·90	2·65	5·82	2·99	9·41	5·20	1·54	2·58	0·03	0·10	99·62
IV.	51·83	18·45	4·97	3·96	2·99	7·55	3·52	1·61	2·45	—	3·00	100·33

L. J. S

Physiological Chemistry.

Blood-coagulation Time. F. L. GOLLA (*Proc. physiol. Soc.*, 1908, lxi—lxii; *J. Physiol.*, **37**).—A modification of Buckmaster's coagulometer is described; it gives very constant results with a given blood. The coagulation time does not exhibit diurnal variation; it is not altered by fasting, or by the internal administration of sodium citrate or calcium salts. Nor is it abnormal in hæmophilia (1 case), purpura (1 case), or urticaria (2 cases). It is markedly prolonged in cases of jaundice, probably because of an alteration in the surface tension of the blood-film. W. D. H.

Effect of Amyl Nitrite on Red Blood Corpuscles. GR. SLAVU (*Compt. rend.*, 1908, **147**, 148—149).—Less than 0·3% of amyl nitrite does not produce a visible spectroscopic change in the blood. Death, after toxic doses have been administered, is not wholly due to want of oxygen, for a considerable quantity of the gas can be extracted from the blood in a vacuum. The oxygen which is set free, both *in vivo* and *in vitro,* is not derived from the plasma, but from the corpuscles.

G. B.

The Behaviour of the Sugar of the Blood after Bleeding. NILS ANDERSSON (*Biochem. Zeitsch.*, 1908, **12**, 1—7).—The statement that the amount of sugar in the blood increases after bleeding is confirmed; this occurs in rabbits, especially after a second bleeding. The blood-sugar consists of 75% dextrose, and the remaining 25% is spoken of as residual sugar; it is not fermentable by yeast and gives a positive orcinol reaction, and so is probably a pentose, but this requires confirmation. Both varieties of sugar increase in the same proportion after bleeding; the total amount may be more than doubled.

W. D. H.

The Blood Issuing from the Dog's Suprarenal. F. A. YOUNG and J. E. LEHMANN (*Proc. physiol. Soc.*, 1908, liv; *J. Physiol.*, **37**).—The blood issuing from the suprarenal gland, especially if it has been dammed back there for a time by a ligature, produces on injection into the general blood stream a decided rise of pressure, and so presumably contains adrenaline.

W. D. H.

Duration of Effect of Pituitary Extract on Blood Pressure. P. LOCKHART MUMMERY and W. LEGGE SYMES (*Proc. physiol. Soc.*, 1908, lvi; *J. Physiol.*, **37**).—In the dog, the elevation of blood pressure produced by injection of pituitary extract may last twenty to thirty minutes; in the pithed cat, it may persist for many hours.

W. D. H.

Influence of Magnesium Sulphate on Metabolism. MATTHEW STEEL (*J. Biol. Chem.*, 1908, **5**, 85—124).—Injection of magnesium sulphate into a muscle, or under the skin, does not cause diarrhœa. The total nitrogen eliminated is somewhat increased, but the most marked effect is the rise, relative and absolute, in urinary ammonia.

W. D. H.

Tolerance to Alcohol. JOSEF PRINGSHEIM (*Biochem. Zeitsch.*, 1908, **12**, 143—192).—In animals accustomed to alcohol, the same quantity is excreted by lungs, kidneys, and skin as in those unaccustomed to its use. In both classes of animals, the fæces are free from alcohol. In both groups the amount united to glycuronic acid in the urine is the same, but that united to sulphuric acid is slightly higher in the "accustomed" animals. The "accustomed" animals burn off the alcohol more rapidly, that is, in about two-thirds of the time occupied in the burning by the "non-accustomed" group. In acute alcoholic poisoning, the percentage of alcohol in the body is about 66% more in the "non-accustomed" animals. The seat of combustion is mainly the liver, then comes heart muscle, and the brain is last. W. D. H.

Temperature-coefficients of Velocities of Various Physiological Actions. Charles D. Snyder (*Amer. J. Physiol.*, 1908, **22**, 309—334).—The large number of observations recorded and tabulated show that the temperature-velocities are all of magnitudes similar to those seen in physical and chemical reactions; in cases where it is known that metabolism occurs, the coefficients observed are those of chemical reactions; under this category are included the shortening of muscle, the latent period of smooth muscle, &c. Coefficients lower than these simulate physical actions, for instance, the latent period of striated muscle. In still other cases, the data are insufficient to draw conclusions from, as, for instance, the latent period of cardiac muscle and of vagus stimulation, and the velocity of urinary secretion and of lymph formation. W. D. H.

Effects of Variations in Inorganic Salts and Reaction on Plants and Animals. Benjamin Moore, Herbert E. Roaf, and Robert E. Knowles (*Bio-Chem. J.*, 1908, **3**, 279—312).—The range of ionic concentrations compatible with life is a narrow one. Short of the lethal dose, life and growth of plants are stimulated by alkali and not by acid. Potassium is more stimulating than sodium to both rootlets and flowers. The phosphatic anion causes increase in size, but irregularities in the flowers. In amphibia, both acid and alkaline phosphates increase growth. Higher concentrations cause death, which in the case of the alkaline salt is preceded by hyperexcitability. In mammals, alkaline and acid phosphates, in doses of 0·26—0·38 gram per kilo. of body-weight, cause increased metabolism, diminishing body-weight, and finally death. The adipose and muscular tissues waste considerably; other symptoms are polyuria, and with large doses, diarrhœa with ulceration of the alimentary canal, leucocytosis, degeneration of liver cells, and nephritis. The alkalinity of the serum is increased by the alkaline and diminished by the acid salt. W. D. H.

Chemical Composition of the Herring during the Reproductive Period. Thomas H. Milroy (*Bio-Chem. J.*, 1908, **3**, 366—390).—The herring undoubtedly feeds until spawning time, and so differs from the salmon; the herring is therefore not dependent on its muscle proteins for the growth of its ovaries. In the male, as in the female, the highest fat percentage is found in the muscles just before rapid growth of the reproductive organs occurs; then it falls. The year may be divided into three periods: (1) The restitution or feeding period, three to four months before spawning; the spent fish recovers and accumulates a store of fat. (2) The ripening period, six to seven months. The fish still takes food, but in less amount, and the sexual organs grow as the store of muscle fat lessens. (3) The spawning period, two months; during this time feeding stops, the fat in the muscles falls greatly, and the water increases. W. D. H.

Glycogen of Frog's Spawn. E. HAENSEL (*Biochem. Zeitsch.*, 1908, **12**, 138—142).—Glycogen is present in frog's spawn in amounts varying from 0·016 to 0·052% of the fresh, or from 1·28 to 4·08% of the dry, material. The estimations were made by Pflüger's method. The addition of dextrose, lactose, or sucrose to the spawn causes a rise in the yield of glycogen. W. D. H.

Influence of Strontium on the Growth and Composition of Bone. HELENE STOELTZNER (*Biochem. Zeitsch.*, 1908, **12**, 119—137). —The experiments recorded on growing dogs show that if the diet is poor in calcium, or if the calcium is partly replaced by strontium, the bone condition that results differs from that seen in rickets; in the latter condition, the relationship of calcium to fat-free dry substance is lessened, but this was not the case in the experimental puppies. Strontium is laid down in the bone in relatively important amount, but it does not seem able to take the place of calcium in producing healthy bone. W. D. H.

Chemistry of Muscle and Liver of Reptiles. JOHN F. LYMAN (*J. Biol. Chem.*, 1908, **5**, 125—127).—Four kilograms of fresh muscle and the livers from two pythons were examined. From the muscle, creatine and sarcolactic acid were separated and identified. The most conspicuous purine derivative is hypoxanthine, as in higher vertebrates.

From the livers, uric acid, guanine, and adenine were obtained. Xanthine and hypoxanthine could not be separated in amounts sufficient for identification. W. D. H.

Contraction of Muscle in Relation to the Presence of Receptive Substances. II. JOHN N. LANGLEY (*J. Physiol.*, 1908, **37**, 165—212. Compare this vol., ii, 120).—Further details of the phenomena of nicotine poisoning in frog's muscle, which support the author's previous contention that there exist in the muscle, or its nerve-endings, or both, substances with which the nicotine combines. W. D. H.

Cholesterol in Cœlenterata. CHARLES DORÉE (*Proc. physiol. Soc.*, 1908, lviii—lix; *J. Physiol.*, **37**).—Cholesterol is generally regarded as a constant constituent of cell protoplasm. It is certainly present in sea-anemones. W. D. H.

Kidney Secretion of Indigo-carmin, Methylene-blue, and Sodium Carminate. GEORGE D. SHAFER (*Amer. J. Physiol.*, 1908, **22**, 335—352).—The experiments recorded confirm Heidenhain's views on urinary formation; indigo-carmin, leuco-indigo-carmin, and methylene-blue are secreted at varying rates by the convoluted tubules and the wider limb of Henle's loop. Sodium carminate, on the other hand, passes out by the glomeruli. W. D. H.

[Symptomatic] Significance of Urinary Indoxyl. Detection of Indole in Pus. CHARLES PORCHER (*Compt. rend.*, 1908, **147**, 214—217).—Pus, diluted with water and made alkaline, is distilled with steam; the indole is extracted from the distillate by pure benzene, in which it is detected by the colour reaction with *p*-dimethylaminobenzaldehyde. In less than half the number of specimens examined, indole was present; its formation seems to depend on the presence of particular organisms. G. B.

Renal Calculi. J. SYDNEY ROWLANDS (*Bio-Chem. J.*, 1908, **3**, 346—350).—A series of twenty-two calculi from South-west Lancashire and North Wales was examined. The commonest constituent was found to be calcium oxalate. Uric acid was rare, and was absent in nineteen cases. W. D. H.

Concentration of Diphtheria Toxin. P. G. HEINEMANN (*J. Biol. Chem.*, 1908, **5**, 27—30).—A high potency diphtheria toxin is advantageous in the production of diphtheria antitoxin. Concentration of the former by precipitating with alcohol or salts of heavy metals is accompanied by loss of potency; this, however, is minimised by the use of neutral salts as the precipitating agent. In the present research, ammonium sulphate was used; the salt was subsequently removed by dialysis through heavy parchment. Phenol was then added to the re-dissolved precipitate as a preservative to the extent of 0·3%; more than this precipitates the toxin. The loss of potency is very slight. W. D. H.

Experimental Glycosuria. II. Glycogenolytic Fibres in the Great Splanchnic Nerve. JOHN J. R. MACLEOD. **III. Influence of Stimulation of the Great Splanchnic Nerve when the Liver is Deprived of its Blood Supply.** JOHN J. R. MACLEOD and H. O. RUH (*Amer. J. Physiol.*, 1908, **22**, 397—409).—Stimulation of the great splanchnic nerve in dogs produces marked hyperglycæmia within half an hour, accompanied by diuresis and glycosuria. If the stimulation is continued for hours, these effects reach a maximum in about two hours and then decline. Liberal administration of oxygen lessens, but does not abolish, the effect; atropine, also, does not prevent the effect. Ligature of the hepatic artery or clamping of the portal vein do not in themselves produce hyperglycæmia. The glycogen which disappears from the liver is greater in amount when the nerve is stimulated when the portal blood is diverted into the inferior vena cava than when the stimulation is omitted. This, however, is not conclusive evidence in favour of glycogenolytic secretory fibres, for the stimulation might produce bloodlessness of the liver by constricting the hepatic artery. If, however, the glycogen still disappears during stimulation of the nerve, when the liver is rendered completely anæmic by ligature of the portal vein and hepatic artery, then the existence of such nerve-fibres is definitely proved. In two out of three experiments, the disappearance was greater during a ten minute period of stimulation than in the preceding ten minutes when no stimulation was employed. If no stimulation is used at all, the rate of disappearance during the second ten minutes is the same as, or less than, that occurring during the first period. W. D. H.

Calcium Metabolism in Relation to Rickets. Hans Aron (*Biochem. Zeitsch.*, 1908, **12**, 28—77).—A critical and experimental review of calcium metabolism in relation to the ætiology of rickets. The lack of calcium may be due to the small amount in the food, or to its non-absorption, or to its too rapid excretion. The experiments recorded on animals, together with observations on human infants, show the overwhelming importance of the first of these three factors. The effect falls mainly on the skeletal structures, for the amount of calcium may remain normal in other organs. Among the interesting points raised are: (1) the poorness of human milk in calcium, and the suggestion is made that weaning should occur at an earlier date than that usually laid down; and (2) the fact that the milk of mothers of rickety children is poorer in calcium than that of other women in relation to the organic constituents in the milk. Doubtless other factors also step in, especially rapidity of growth in such children.

W. D. H.

Arsenic and Trypanosomes. Martin Jacoby and Albert Schütze (*Biochem. Zeitsch.*, 1908, **12**, 193—202).—Phagocytosis does not appear to be a factor in the defence of the body against trypanosomes, and the beneficial influence of arsenic is not due to its stimulating leucocytic activity, but rather to its direct influence on the parasites.

W. D. H.

Pharmacological Action of *cyclo*Hexane and Some of its Derivatives. A. Brissemoret and J. Chevalier (*Compt. rend.*, 1908, **147**, 217—219).—A comparison of the action of *cyclo*hexane, *cyclo*hexanol, *i*-quercitol, and inositol on the action of the isolated rabbit's heart perfused with Locke's solution. The primary effect (contraction of the heart's muscle) of all four substances is attributed to their having a common carbon skeleton. With *cyclo*hexane, and especially with *cyclo*hexanol, the toxic effect on the nerves of the heart is most prominent.

G. B.

[Physiological] Action of Substances of the Saponin Group. Leonhard Wacker (*Biochem. Zeitsch.*, 1908, **12**, 8—14).—Substances of the saponin group obtained from various plants appear to differ in toxicity; the experiments recorded (on dogs) were performed with a mixture of quillajic acid and sapotoxin. Deleterious effects on the kidney are described. The toxic action on the blood is less if the drug is given by the mouth, and the addition of extracts of the intestinal mucous membrane to solutions outside the body lessens their hæmolytic properties; the gastric mucous membrane is even more powerful in the same direction.

W. D. H.

Absorption of Certain Poisonous Gases by the Respiratory Tract. Karl B. Lehmann, Joseph Wiener, Johannes Willke, and Jiro Yamada (*Arch. Hygiene*, 1908, **67**, 57—98).—If the air contains from 0·2 to 0·3% of ammonia, from 80 to 90% of this is absorbed, and absorption is mainly brought about by the nasal and buccal mucous membranes. If the mixture is passed directly into the lungs of an animal, about 56% of the ammonia is absorbed, but it is not possible to say whether the absorption occurs in the bronchial tubes or in the alveoli.

Hydrogen chloride is absorbed by the nose and trachea to the extent of 60—75%. An animal in this way absorbed 252 milligrams of the gas in an hour, sufficient to produce acid poisoning; injury to the mucous membrane is also readily produced. Sulphur dioxide is absorbed by the same channels to the extent of 35—58%. It is relatively more toxic than hydrogen chloride. Acetic acid vapour is less toxic than hydrogen chloride. It produces hyperæmia and acidity of the mucous membrane, but no hæmorrhage. The amount absorbed varies from 62 to 86%. A few experiments on carbon disulphide are also given; the amount absorbed is about 20—22%. Full analytical details are given throughout; the experiments on animals were supplemented throughout by experiments on man. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Action of Heavy Metals on Bacillus Typhorus. BENJAMIN MOORE and JAMES LEONARD HAWKES (*Bio-Chem. J.*, 1908, **3**, 313—345).—The investigation was undertaken on fresh-water mussels with a view to their purification from the bacillus of typhoid fever. Ferrous sulphate and ferric chloride solutions (1 in 1000) act beneficially on the mussels, and kill all the bacilli in twenty-five hours. Salts of silver, copper, zinc, and lead were found to be useless; they either act detrimentally on the mussels, or do not free them from the bacilli in a reasonable time. W. D. H.

Fermentation of Malic Acid in the Production of Wine. AUGUSTE ROSENSTIEHL (*Compt. rend.*, 1908, **147**, 150—153. Compare Mestrezat, this vol., ii, 723).—Malic acid is transformed into lactic acid and carbon dioxide by *Micrococcus malolacticus* occurring in the grape; in order to secure proper ripening of the wine, this bacillus should not be allowed to develop rapidly, so that the malic acid disappears slowly. G. B.

Fermentation of Calcium Tartrate. OSKAR EMMERLING (*Centr. Bakt. Par.*, 1908, ii, **21**, 317—318).—The experiments were made with a Spirillum found in the waste waters from a tannery. When inoculated into a culture solution containing inorganic and organic food substances and solid calcium tartrate, it was found to decompose the latter salt quantitatively, giving rise to calcium carbonate and carbon dioxide. Thus, in one experiment, 5 grams of the tartrate were originally put into the solution, of which 4·3 were decomposed, giving rise to 2·05 grams of calcium carbonate (theor. = 2·2 grams). Decomposition proceeds more rapidly the greater the surface of liquid exposed to the air and the more frequently the liquid is shaken.

In all fermentations of calcium tartrate studied previously, the reaction has been more complex, and has given rise to several fatty acids. E. J. R.

Influence of the Sterilisation Temperature of Grape Juice and of the Fermentation Temperature on the "Bouquet" of Wine. AUGUSTE ROSENSTIEHL (*Compt. rend.*, 1908, **146**, 1417—1420).—The best temperature for sterilisation is 50—52°; at 55—60° the bouquet suffers. It is true that at the lower temperature only a partial sterilisation is achieved, but below 26° the surviving yeast cells do not appreciably resume their growth in the first forty-eight hours, so that there is time for the pure culture, with which it is desired to conduct the fermentation, to establish itself. A further reason for conducting the fermentation at a low temperature (20°) is that at a higher temperature the carbon dioxide evolved carries away substances the scent of which makes up the bouquet. The gases given off may be passed into sterile grape juice, to which they communicate the bouquet. G. B.

De-amidising Ferments of Fungi. HANS PRINGSHEIM (*Biochem. Zeitsch.*, 1908, **12**, 15—25).—Various fungi, such as yeast and *Aspergillus niger*, have the property of liberating ammonia from nitrogenous substances, especially from amino-acids. This is due to enzymatic action. After treatment with acetone and ether, this property is lost. The de-amidised residue is changed into alcohols, with the evolution of carbon dioxide, by an enzyme contained in yeast, which is also killed by acetone and ether. The theoretical bearing on these facts in relation to the growth of fungi is discussed.

W. D. H.

Influence of the Concentration of Sugar Solutions on Respiration [of Seedlings]. A. MAIGE and G. NICOLAS (*Compt. rend.*, 1908, **147**, 139—142).—Bean seedlings placed for fifteen to twenty-two hours in sugar solutions of various concentrations (up to 10%) showed increased intensity of respiration, both normal and intramolecular. With all sugars examined, except lactose, the respiration increases progressively with the concentration. G. B.

Behaviour of Certain Organic Substances in Plants. I. GIACOMO L. CIAMICIAN and C. RAVENNA (*Gazzetta*, 1908, **38**, i, 682—697).—The glucosides amygdalin, salicin, and arbutin are tolerated by maize and French beans to a much greater extent than the aromatic substances present in the glucosides, namely, benzaldehyde, saligenin, and quinol. The plants into which the latter are introduced die within three days, whilst those treated with the glucosides reach complete maturation. In a period of two months, a single plant can be treated with as much as 3 grams of glucoside without injury.

The glucosides introduced into the plants undergo partial hydrolysis, and are apparently utilised by the plants, since extraction of the latter only yields a fraction of the total glucoside introduced.

T. H. P.

Mechanism of the Distribution of Odoriferous Principles in Plants. Eugène Charabot and G. Laloue (*Compt. rend.*, 1908, **147**, 144—145).—In general, those constituents of an essential oil which are most soluble in water are most readily transported from the leaves to the flowers. Menthol is more soluble than menthone, yet in peppermint plants the flowers contain more menthone than the leaves. This is, however, the result of oxidation of the menthol after it has been transported into the flowers, and therefore a secondary effect.
G. B.

Chemical Changes Consequent on the Wounding of Plants. Rudolf Friedrich (*Centr. Bakt. Par.*, 1908, ii, **21**, 330—347).—The author gives a full résumé of previous work on the subject, dealing especially with (*a*) the increased evolution of carbon dioxide, (*b*) the increased production of protein, in wounded potatoes and onions. He finds that the former of these phenomena is also shown by other parts of plants (leaves, fruit, &c.), but not always the latter; thus potatoes and oak leaves respectively gave the following results:

	Total N.	Protein N.	Amide N.	Carbo-hydrate.	Acidity.
Potatoes (tubers), wounded	1·476	1·250	0·123	70·260	24·350
,, not wounded.....	1·301	0·888	0·167	73·820	21·430
Oak leaves, wounded..................	5·171	3·557	1·230	8·191	59·530
,, not wounded	5·392	3·498	1·004	12·436	48·896

The figures refer to percentages on the dry substance.

The fall in carbohydrate is correlated with the increased respiration, but the increase in acidity is not discussed, since the acids actually produced were not investigated. It was found that the protein production in the wounded potato, onion, and pear depended on the presence of the large amount of carbohydrate; the fruits of *Cydonia japonica* and leaves of *Clivia Gardneri*, which behaved like oak leaves, contained only small quantities. This observation lends support to Pfeffer's view that protein is formed from plants by a reaction between carbohydrate and amide material.
E. J. R.

Origin of the Colouring Matter of Red Grapes and of Other Plant Organs. J. Laborde (*Compt. rend.*, 1908, **146**, 1411—1413 *).—By heating the solid parts of young, green grapes with 2% hydrochloric acid to 120° for thirty minutes, a red colouring matter is formed from the tannins. A similar pigment may be formed by boiling with alkali in the presence of air.
G. B.

Oxydase in the Latex of Hevea Brasiliensis. David Spence (*Bio-Chem. J.*, 1908, **3**, 351—352).—Four samples of this latex (Para rubber) gave marked evidence of the presence of an oxidising enzyme.
W. D. H.

Ripening of Tomatoes (Lycopersicum esculentum). F. M. Albahary (*Compt. rend.*, 1908, **147**, 146—147).—During ripening, a considerable increase in the amount of organic acids, sugars, starch, and non-protein nitrogenous substances takes place, whilst proteins and cellulose diminish.
G. B.

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* and *Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 76—78.

Physiological Action of Dicyanodiamide. OSCAR LOEW (*Chem. Zeit.*, 1908, 32, 676—677).—Whilst under ordinary conditions calcium cyanamide decomposes entirely into calcium and ammonium carbonates, in alkaline soils there is a possibility of a partial production of dicyanodiamide. According to Ulpiani and Perotti (Abstr., 1907, ii, 295), the latter compound is not poisonous to crops, and may even be employed as a source of nitrogen; Kappen showed that it is very slowly converted into ammonia.

Experiments in which young barley plants (14—16 cm. high) were placed in a 0·5% solution of dicyanodiamide showed an injurious action after two days. In the case of small *Lathyrus* plants, no injurious action was observed until several days later, owing, perhaps, to evaporation being less. With 0·05—0·1% solutions, only the points of the leaves were affected; solutions of guanidine hydrochloride of the same strength killed barley plants in a few days.

Further experiments with twigs of *Tradescantia* in 0·1%, and *Elodea* in 0·2%, solutions of dicyanodiamide showed that no injurious effect was produced in either case, and that *Elodea* utilised dicyanodiamide as a source of nitrogen. The poisonous effects observed by Immendorff and Wagner were, perhaps, due to some decomposition product. Threads of *Spirogyra* in 1% solutions of dicyanodiamide remained intact for several days; worms lived for more than four days in 0·5% solutions. Bacteria in broth containing 0·5% were not injured in the least.

As regards the constitution of dicyanodiamide, it is suggested that the imide ring formula (Baumann) best accords with its slightly acid character and with its physiological properties, as compared with dicyanodiamidine and guanidine. N. H. J. M.

Analytical Chemistry.

Automatic Safety Burette. GUSTAV MÜLLER and O. BERCHEM (*Chem. Zeit.*, 1908, 32, 711).—A modification of the apparatus described previously (this vol., ii, 626). The reservoir has been replaced by a tube connected with a large container. The circulation tube is replaced by an overflow chamber fitted with an open conical lid, which is firmly tied to it by means of glass hooks and strong rubber bands. A float, terminating in a cone, serves as a valve, which closes when, after filling the burette, sufficient liquid has entered the overflow chamber. L. DE K.

Detection of Fluorine Compounds in Wines. L. VANDAM (*Ann. Chim. anal.*, 1908, 13, 260—262).—A reply to Carles (this vol., ii, 318). The author proves that the amount of fluorine in œnological products is too small to interfere with the use of his process (this vol., ii, 63). L. DE K.

Apparatus for the Quantitative Distillation of Ammonia. Philip A. Kober (*J. Amer. Chem. Soc.*, 1908, **30**, 1131—1135).—The author has applied Folin's process to the Kjeldahl nitrogen estimations. The fused mass in the Kjeldahl flask, when sufficiently cooled, is mixed with 40—90 c.c. of water (about 4 vols. of water to 1 vol. of sulphuric acid present), and the flask is connected with two cylinders, one containing an amount of aqueous sodium hydroxide more than sufficient to neutralise all the sulphuric acid, and the other, a standard solution of sulphuric acid to absorb the ammonia given off. By applying suction, the alkali is forced into the flask, and the heat developed is sufficient to expel all the ammonia. When all the alkali has been carried over, the cylinder may be disconnected and replaced by an arrangement for supplying ammonia-free air. The suction is continued until the contents of the flask are perfectly cooled down. L. de K.

Folin's Method of Estimating Ammonia in Urine. Matthew Steel and William J. Gies (*J. Biol. Chem.*, 1908, **5**, 71—84).—Certain urines, collected during metabolism experiments with magnesium sulphate, gave discordant results when the ammonia in them was estimated by Folin's method. This is due to the fact that relatively large quantities of ammonio-magnesium phosphate are eliminated under these conditions, some of it being deposited in crystalline form ; this deposit is not thoroughly decomposed by sodium carbonate as used in Folin's process, and so a variable amount of ammonia is lost.

W. D. H.

Limitations of the Copper–Zinc Couple Method in Estimating Nitrates. John E. Purvis and R. M. Courtauld (*Proc. Camb. Phil. Soc.*, 1908, **14**, 441—446).—The authors have examined the accuracy of the copper-zinc couple method of estimating nitrates and nitrites in waters which contain considerable quantities of organic nitrogen compounds, such as soluble peptones, blood-serum, and soluble albumin. From a comparison of the results with those of blank experiments, it is found that the organic nitrogen is to some extent reduced to ammonia under the influence of the couple. Similar results were obtained with a sample of sewage to which known quantities of potassium nitrate were added. It is suggested that the reduction of the organic nitrogen is not merely due to the hydrogen liberated by the couple, but is influenced by the oxygen liberated simultaneously by the electrolytic action. H. M. D.

The Nitro-Molybdate Method for the Detection of Phosphorus in Tissues. G. G. Nasmith and E. Fidlar (*J. Physiol.*, 1908, **37**, 278—284).—In agreement with Macallum, but contrary to the view of Scott, the cold nitric acid employed does separate inorganic phosphates from nucleins and nucleic acids. Bensley's view is acquiesced in that the reduction of compounds of molybdenum is the cause of the bluish-green colour which appears in microscopic preparations, and that it is not due to the presence of phosphorus at all.

W. D. H.

Estimation of Phosphoric Acid. NORBERT VON LORENZ (*Chem. Zeit.*, 1908, **32**, 707—709).—A defence of the author's method (direct weighing as ammonium phosphomolybdate), which is applicable in all cases, whereas the citrate process gives but indifferent results.

L. DE K.

Microchemical Analysis. III. Arsenic, Antimony, Tin. NICOLAAS SCHOORL (*Zeitsch. anal. Chem.*, 1908, **47**, 367—389. Compare this vol., ii, 432).—The process is based on the characteristic microscopical appearance of arsenious acid, ammonium calcium arsenate, ammonium magnesium arsenate, and arsenic iodide. Antimony may be isolated as cæsium antimony chloride or, preferably, iodide, or as sodium antimonate, whilst tin yields characteristic compounds with cæsium and rubidium chlorides, all of which are readily detected microscopically.

Tin and antimony are conveniently separated from arsenic by heating the mixed sulphides obtained in the ordinary course of analysis with 25% hydrochloric acid, which leaves the arsenic practically undissolved. A portion of the filtrate is then tested for tin with rubidium chloride, and another portion for antimony with cæsium chloride and potassium iodide. The arsenic is oxidised with nitrohydrochloric acid, and then converted into the magnesium compound.

L. DE K.

Separation of Lithium Chloride from the other Alkali Chlorides and Barium Chloride. LOUIS KAHLENBERG and FRANCIS C. KRAUSKOPF (*J. Amer. Chem. Soc.*, 1908, **30**, 1104—1115).—The solution of the mixed chlorides is evaporated just to dryness, and the residue, which should not exceed 2 grams, is boiled for a few minutes with 25 c.c. of pyridine; any large particles are crushed with a stirring rod. The clear liquid is decanted through a small filter, and the insoluble matter washed twice with a little hot pyridine. It is then dissolved in a little water, evaporated to bare dryness, and again extracted with hot pyridine. The pyridine filtrates, which contain all the lithium chloride, are mixed, the bulk of the pyridine is recovered by distillation, and the lithium chloride is converted into sulphate by evaporation with sulphuric acid and weighed as such.

L. DE K.

Assay of Telluride Ores. GEORGE BORROWMAN (*J. Amer. Chem. Soc.*, 1908, **30**, 1023—1027).—The irregularities in the assay of high-grade auriferous tellurides are due to lack of homogeneity of the sample, and not, as has been suggested, to the tellurium. In some cases, however, it is advisable to remove the tellurium with nitric acid. Any silver is then precipitated as chloride, and added to the insoluble residue, which is then assayed as usual for gold and silver. The most favourable temperature is about 1200°. L. DE K.

Evaluation of [Commercial] Red Lead. P. BECK (*Zeitsch. anal. Chem.*, 1908, **74**, 465—492).—An exhaustive research as to the most trustworthy methods for the analysis of red lead. The author gives the following summary.

The red lead may be dissolved in dilute nitric acid, and separated from insoluble impurities by the use of such reducing agents as sucrose, oxalic acid, lactic acid, methyl alcohol, formaldehyde, glycerol, phenylhydrazine, salts of hydroxylamine, but best of all by hydrogen peroxide.

When small quantities only are available, Bunsen's process (distillation with hydrochloric acid and estimation of the chlorine liberated) may be used, but in works, Topf's process (titration of iodine liberated from potassium iodide with sodium thiosulphate) should be used, as this allows the use of 5 grams of the sample. L. DE K.

Solubilities of the Oxalates of the Rare Earths. I. Solubility of the Oxalates of Lanthanum, Cerium, and Samarium in dilute Sulphuric and Oxalic Acids or their Mixtures. OTTO HAUSER and FRITZ WIRTH (*Zeitsch. anal. Chem.*, 1908, **47**, 389—400).—Tables showing the solubility of the oxalates of the cerium group in dilute sulphuric and oxalic acids, and in a mixture of the two; the strength of the acids varies from $0{\cdot}05N$ to $4{\cdot}3N$.

As a result of this investigation, the following process is recommended. The rare earths are separated from accompanying alkaline earths by precipitation with ammonium chloride and pure ammonia. The washed precipitate is dissolved in hydrochloric acid, and, after expelling the excess by evaporation, the residue is dissolved in about 60 parts of $N/4$—$N/2$ sulphuric or hydrochloric acid. A saturated solution of oxalic acid is then added in such quantity that the solution will contain about 3% of that acid. If lanthanum is present in large excess, ammonium oxalate should be used. In presence of more acid, the process becomes quite inaccurate for lanthanum, and less accurate for cerium. L. DE K.

Influence of Fine Grinding on the Water and Ferrous Iron Content of Minerals and Rocks. WILLIAM F. HILLEBRAND (*J. Amer. Chem. Soc.*, 1908, **30**, 1120—1131).—A series of tabulated experiments on the influence of fine grinding on minerals containing ferrous iron and on the iron and water content. In order to avoid oxidation, it is recommended that the grinding should be effected under alcohol, or, better still, the coarse powder should be treated directly with hydrofluoric acid and the solution titrated for ferrous iron; any undissolved matter is then finely ground under water, and again treated with hydrofluoric and sulphuric acids (for details, compare *Bull.* **305**, *U.S. Geol. Survey*, 142). L. DE K.

Volumetric Estimation of Iron and Chromium by means of Titanous Chloride. S. B. JATAR (*J. Soc. Chem. Ind.*, 1908, **27**, 673—674).—The principles involved in the method are: (1) hydrogen peroxide oxidises chromium salts in alkaline solutions to chromates, these becoming dichromates on acidifying the solutions; (2) hydrogen peroxide reduces dichromates to chromates in acid solutions, ferric salts being unchanged; (3) on titrating a mixture of a dichromate and a ferric salt, for all practical purposes the dichromate is reduced first, the colour change marking the reduction and the ferric salt being left in solution. Of these, the first one is involved in bringing the iron and chromium in an ore into solution; on the second and third, the following process depends. A weighed quantity of about 0·5 gram of the finely-powdered ore is fused with a mixture of sodium hydroxide and sodium peroxide, more of the latter being added subsequently. After cooling, the fused mass is extracted with water, the solution is boiled to remove all traces of hydrogen peroxide, then acidified with sulphuric acid, and again boiled and diluted to a volume of 500 c.c. Fifty c.c. of the solution are titrated with standardised titanous chloride solution until a clear violet coloration is obtained, showing that all the dichromate is reduced; a few more drops of titanous chloride are added to make sure that only the ferric salt remains in solution, then a few drops of thiocyanate solution are added as indicator, and the solution is titrated until the colour disappears. The volume of titanous chloride solution used represents the dichromate and iron together. A second 50 c.c. of the solution are treated with hydrogen peroxide to reduce the dichromate, and the mixture is boiled to expel the excess of hydrogen peroxide. When cold, the solution is titrated with titanous chloride solution, a few drops of thiocyanate solution being added as an indicator. In this titration, the volume of titanous chloride used represents the amount of iron only. A sensitive indicator may be prepared by adding a few drops of potassium thiocyanate solution to a dilute ferrous sulphate solution. W. P. S.

Estimation of Nickel and Chromium in Steel. EDWARD D. CAMPBELL and WALTER ARTHUR (*J. Amer. Chem. Soc.*, 1908, **30**, 1116—1120).—A modification of Moore's process. One gram of the sample is converted into sulphate by evaporating with nitric acid and sulphuric acid, and to the solution, measuring about 70 c.c., 13 grams of sodium pyrophosphate dissolved in 70 c.c. of hot water are added. This is preferable to the citric acid usually employed. The precipitate is dissolved by cautious addition of ammonia, and warming towards the end.

Five c.c. of 0·05% silver nitrate and then 5 c.c. of 2% potassium iodide are added, and standardised potassium cyanide is run in until a clear liquid has been obtained. If copper is present, it must be remembered that 1 part of this counts for $\frac{3}{4}$ part of nickel. Copper, however, may be left undissolved by avoiding the use of nitric acid. If chromium is also present, it must be rendered harmless by oxidation with potassium permanganate before adding the pyrophosphate. If chromium only has to be estimated, the chromic acid thus formed is titrated in the usual way with ferrous ammonium sulphate and permanganate. L. DE K.

Separation of Tungsten from Chromium. Estimation of Tungsten in Steel containing Chromium. GEORG VON KNORRE (*Zeitsch. anal. Chem.*, 1908, **47**, 337—366).—1·5—6 Grams of the sample are dissolved in a small quantity of dilute hydrochloric acid. When no further action takes place on boiling, the excess of acid is at once neutralised with sodium hydroxide, and, when cold, 8—10 c.c. of *N*/10 sulphuric acid are added, and then, without previous filtration, 30—60 c.c. of benzidine reagent (20 grams of benzidine and 25 c.c. of concentrated hydrochloric acid per litre). The precipitate, which contains all the tungsten, also more or less chromium, is washed with the diluted reagent and burnt in a platinum crucible. The ash is then fused with sodium carbonate, and the mass extracted with water. The filtrate is acidified with hydrochloric acid, using methyl-orange as indicator, and then boiled for some time to convert the tungsten into metatungstic acid. When cold, the chromic acid is reduced by a solution of sulphur dioxide, and the tungsten precipitated with excess of the benzidine reagent. Addition of sulphuric acid is, as a rule, unnecessary, as enough is formed owing to the oxidation of the sulphur dioxide. On ignition, pure tungsten trioxide is obtained.

L. DE K.

Volumetric Estimation of Titanium. GINO GALLO (*Gazzetta*, 1908, **38**, i, 658—659. Compare Abstr., 1907, ii, 402, and Knecht and Hibbert, Abstr., 1903, ii, 509).—Titanium is usually accompanied by iron, so that the method given by Newton (this vol., ii, 325) for the volumetric estimation of titanium is inapplicable in practice.

T. H. P.

Purity and Volatility of Precipitated Antimony Sulphide. LEWIS A. YOUTZ (*J. Amer. Chem. Soc.*, 1908, **30**, 975—979).—Antimony sulphide precipitated from a solution containing free hydrochloric acid is never pure, but is always contaminated with more or less antimony oxychloride, which cannot be removed even by redissolving the precipitate in ammonium sulphide and reprecipitating with acetic acid. In practice, this admixture does not interfere with the accuracy of the analysis if care is taken to heat the precipitate in an atmosphere of carbon dioxide at 250° only just long enough to transform it into the black sulphide; a prolonged heating causes volatilisation of the antimony oxychloride, and consequent loss.

Antimony sulphide precipitated from a solution free from chlorides does not suffer loss on prolonged heating at 250° in a current of carbon dioxide.

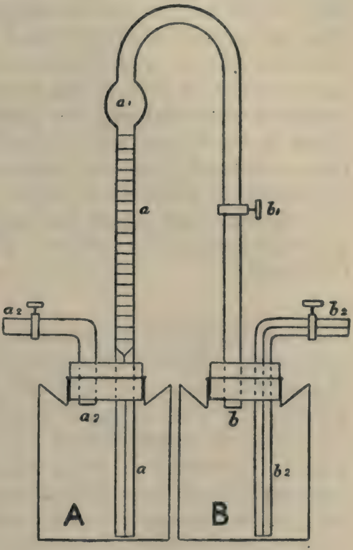
L. DE K.

Electrolytic Estimation of Bismuth. J. PESET (*Zeitsch. anal. Chem.*, 1908, **47**, 401).—0·04—0·08 Gram of a bismuth salt is heated with 4—5 c.c. of water and 3 c.c. of sulphuric acid, and, when all is dissolved, the solution is diluted to 140 c.c. and submitted to electrolysis, using a rotating anode. Conditions: 2 volts; 0·002 to 0·01 ampere; temperature, 50°; time, eighteen to twenty hours. When the solution is quite free from bismuth, 0·08—0·15 gram of accurately-weighed cadmium sulphate dissolved in 10 c.c. of water is added, and the electrolysis is continued now under the following conditions: 2·5—3·5 volts; 0·2—0·3 ampere; time, eight hours.

The cadmium thoroughly protects the bismuth from oxidation, and renders it more adhesive.

L. DE K.

Simple Form of Apparatus for Observing the Rate of Absorption of Oxygen by Polluted Waters and by other Fermenting Liquids. Walter E. Adeney (*Sci. Proc. Roy. Dubl. Soc.*, 1908, **11**, 280—287).—It has been shown (Abstr., 1896, ii, 322; 1898, ii, 86; 1902, ii, 221) that the determination of the extent and rate of absorption of oxygen is of fundamental importance in the examination of polluted waters. A simple apparatus for carrying out these determinations has now been devised, and is figured in the accompanying diagram. Flask *B* is charged with the polluted water and *A* with distilled water. The taps a_2 and b_2 being closed, absorption takes place in *B*, but not in *A*, which acts therefore as a standard pressure gauge. The difference of pressure read off on the graduated tube *a*, in which the distilled water rises when b_1 is opened, shows the amount of absorption in *B*. The original should be consulted for details as to the size of the apparatus, the method of use, and the manner of calculating the results. G. Y.



Detection of Free Acids in Organic Liquids. Fernand Repiton (*Ann. Chim. anal.*, 1908, **13**, 269—270).—Five c.c. of Fehling's solution are boiled in a test-tube, and, if no change takes place, a few drops of the solution to be tested for acidity are added, when a precipitation of copper oxide takes place. One drop of an *N*/10 acid solution will give the test. L. de K.

Physico-chemical Analysis of Wines. Paul Dutoit and Marcel Duboux (*Compt. rend.*, 1908, **147**, 134—137).—A strong solution of baryta is added in small portions to the wine, the conductivity of which is measured after each addition. At first the conductivity falls, and a sharp minimum indicates the point at which all the sulphates have been precipitated. It then rises to a maximum, corresponding with neutrality to litmus. On further addition of baryta, a gelatinous precipitate occurs, and the curve of conductivity shows a shallow dip, the length of which is a measure of the amount of tannins present. After this, the conductivity rises in a straight line. In one operation, three constituents of the wine are thus determined, the sulphates and acids with great accuracy. G. B.

Origin and Variations of Sulphates in Beer. Interpretation of Analytical Results. ACHILLE MÜNTZ and J. AUGUSTE TRILLAT (*Ann. Chim. anal.*, 1908, **13**, 253—260).—An investigation to ascertain whether the presence of more than 2 grams of potassium sulphate per litre in beer should be called adulteration. The authors point out that even more than 2 grams may be fully accounted for by the sulphate derived from the water (Burton water, for instance) and the other materials used in the brewing process. The potassium is derived mainly from the malt, and is often present in sufficient quantity to cover the sulphate fully; the authors, however, doubt whether even then it is really permissible to calculate and report all the SO_3 found as potassium sulphate.

A further quantity of sulphate is due to the sulphuring of the hops or from the use of sulphites; a special test should be made to detect the latter. L. DE K.

Detection of Thiocyanic Acid by means of Mercurous Chloride. EGIDIO POLLACCI (*Chem. Zentr.*, 1908, i, 1576; from *Arch. Farmacol. sperim.*, 7, 94—96).—To detect thiocyanic acid in saliva, 12—15 c.c. are warmed with 40—42 c.c. of absolute alcohol, the filtrate is concentrated to 6—7 c.c., and the residue again filtered. On adding mercurous chloride, this will be reduced in the cold to metallic mercury, which reaction is characteristic for thiocyanic acid. The process may be applied also to solid animal matter. L. DE K.

Estimation of Citral in Lemon-grass Oil. ARMAND BLOCH (*Chem. Zentr.*, 1908, i, 1500; from *Bull. Sci. Pharmacol.*, 1908, **15**, 72—77).—Ten c.c. of the sample are introduced into a 100 c.c. flask, the neck of which holds fully 10 c.c., and is graduated to 0·1 c.c. Twenty c.c. of a recently-prepared 30% sodium hydrogen sulphite solution are added, and the mass shaken until solidified. After fifteen minutes, the flask is suspended in a water-bath at 85°, and, when with constant shaking the mass has liquefied, the flask is three-fourths filled with the sulphite solution. After four to six minutes, a layer of oil will have formed, and more of the reagent is then added until the flask is filled up to the neck. After eight minutes, more is added so as to fill the graduated neck, and, after keeping the flask in the water-bath for another ten minutes, it is taken out and allowed to cool. The volume of unabsorbed oil is then read off. L. DE K.

Titration of Chloral Hydrate. JULES GARNIER (*Chem. Zentr.*, 1908, i, 1492; from *Bull. Sci. Pharmacol.*, 1908, **15**, 77—82).—In order to prevent a secondary reaction from taking place between the chloroform formed and the alkali, the test should be carried out as follows: 0·1655 gram of the sample is dissolved in 10 c.c. of water, and 12·5 c.c. of $N/10$ potassium hydroxide are added. The temperature should not exceed 15°, and, after fifteen to twenty minutes, the excess of alkali is titrated with $N/10$ sulphuric acid, with phenolphthalein as indicator. Another experiment should then be made, using only the slightest excess of alkali. L. DE K.

Estimation of Acetone in Urine. T. STUART HART (*J. Biol. Chem.*, 1908, **4**, 477—482).—The acetoacetic acid in the urine is first converted into acetone by heating at 100°; the acetone is then drawn by a current of air into the absorbing cylinder, as in Folin's method (Abstr., 1907, ii, 588). The values for total acetone plus acetoacetic acid closely approximate to those obtained by the more lengthy Messinger-Huppert procedure. W. D. H.

The Estimation of Indole in Fæces by Herter and Foster's Method. E. GORTER and W. C. DE GRAAFF (*Pharm. Weekblad*, 1908, **45**, 842—845).—Fæces are distilled with steam in presence of potassium hydroxide, and the distillate again distilled with steam after acidification with sulphuric acid. The indole is estimated in the second distillate by Herter and Foster's colorimetric method, using a standard solution prepared from pure indole. A. J. W.

Direct Application of Kerner's and of Liebig-Hesse's Process to Quinine Disulphate. PIETRO BIGINELLI (*Chem. Zentr.*, 1908, i, 1499—1500; from *Mon. Sci.*, 1908, [iv], **22**, 185—187).—The conversion of the quinine disulphate into the normal salt is effected in the cold by lead carbonate (also compare Abstr., 1907, ii, 317). L. DE K.

Estimation of Casein: Determination of its Molecular Weight. GEORG TH. MATTHAIOPOULOS (*Zeitsch. anal. Chem.*, 1908, **47**, 492—501).—The process is based on the fact that casein forms a definite compound with sodium hydroxide when using phenolphthalein as indicator; in this compound, the casein seems to have a molecular weight of 1131·5, practically agreeing with the molecular weight 1135 attributed to it by Laqueur and Sackur (Abstr., 1903, i, 300).

The analysis is conducted as follows: In two separate beakers are placed 80 c.c. of water and 20 c.c. of milk, *N*/25 sulphuric acid is added to the milk until the casein appears to be completely precipitated, and the same amount is then added to the second beaker; as a rule, some 21 c.c. are required. To the contents of the control beaker is now added 1 c.c. of 1% alcoholic phenolphthalein, and the whole titrated with *N*/10 sodium hydroxide. The contents of the other beaker are filtered until 100 c.c. of a clear filtrate have been obtained. This is then also titrated with *N*/10 soda, and, after making an allowance for the dilution caused by the acid added, the difference in the titrations represents the alkali absorbed by the casein; 1 c.c. of *N*/10 alkali = 0·11315 gram of casein. L. DE K.

Pettenkoffer's Reaction. GABRIEL GUÉRIN (*J. Pharm. Chim.*, 1908, [vi], **28**, 54—54).—The Pettenkoffer reaction for biliary acids is due to the formation of a trace of furfuraldehyde from the sugar added, and, in fact, a trace of this aldehyde may be substituted for the sugar.

The author now states that if a larger quantity of furfuraldehyde is employed, the colour generated is not purple, but blue. The test may be applied as follows: A small quantity of the biliary salts is dissolved in 1—2 c.c. of alcohol, 5—6 drops of a saturated aqueous solution of furfuraldehyde are added, and then slowly an equal volume of sulphuric acid, when the blue colour will be developed at once. If an aqueous solution has to be tested, twice the quantity of furfuraldehyde should be employed.

The blue coloration is due entirely to the formation of cholic acid.

L. DE K.

Colour Test for Alypine and various other Local Anæsthetics. P. LEMAIRE (*Ann. Chim. anal.*, 1908, 13, 301—303).—The author has successfully applied the sulphonation test for benzoic acid to some local anæsthetics.

Two c.c. of pure sulphuric acid are placed in a test-tube, 0·05 gram of the substance is added, and the mixture heated until white fumes appear. 0·4 Gram of potassium nitrate in fine crystals is then added in small portions, and, when cold, the liquid is poured carefully into a beaker containing 25 c.c. of dilute ammonia (1 : 1). On adding a drop of ammonium hydrogen sulphide, a reddish-brown coloration appears. The test is successful with alypine (benzoyltetramethyldiaminopentanol hydrochloride), stovaine (benzoyldimethylaminopentanol hydrochloride), cocaine hydrochloride, tropacocaine hydrochloride, α-eucaine hydrochloride, and β-eucaine hydrochloride.

With other substances of this class, the test is indistinct, owing to secondary reactions.

L. DE K.

General and Physical Chemistry.

Refraction and Dispersion of Helium. KURT HERRMANN (*Ber. deut. physikal. Ges.*, 1908, **6**, 476—482. Compare this vol., ii, 333).—Measurements of the refraction of air, hydrogen, and helium have been made for the cadmium line $\lambda = 0{\cdot}6438\mu$. The values of the refractive index are for air 1·0002930, hydrogen 1·0001380, helium 1·00003406, at 0° and 760 mm. The values of v in the expression for the relative dispersion $1/v = (n_F - n_C)/(n_D - 1)$, where n_F, n_C, and n_D are the refractive indices for the lines F, C, and D, are for air 98·0, hydrogen 65·9, and helium 39·9. H. M. D.

Index of Refraction of Mixtures of Alcohols and Water. II. ANTONY G. DOROSCHEWSKY and S. V. DVORSCHANTSCHIK (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 908—931. Compare this vol., ii, 241).—The curves connecting the index of refraction of aqueous alcohol with the proportion of alcohol present for thallium, lithium, and sodium lights are of the same type, all exhibiting maxima at the same concentration; the curves become less convex as the wave-length is increased. Rise of temperature also results in a flattening of the curve, and in a displacement of the position of the maximum towards the water axis.

When water is added to *iso*propyl alcohol, a well-defined maximum refrangibility, corresponding with 93—94% of the alcohol, is observed. With normal propyl alcohol, a less clearly marked maximum exists at about 97%. With butyl and *iso*butyl alcohols, addition of water causes lowering of the index of refraction, no maximum being observed. The rate of change of the index of refraction with temperature, dn/dt, also varies regularly, exhibiting a maximum in the region of the maximum index of refraction. In general, the magnitude of dn/dt for propyl, *iso*propyl, butyl, and *iso*butyl alcohols varies little, but diminishes slightly as the molecular weight of the alcohol increases, and is greater for the *iso*alcohols than for the normal ones.

The value of a in Pulfrich's formula (*Zeitsch. physikal. Chem.*, 1889, **4**, 561) $(n - n_v)/n = a(D - D_v)/D$ has been calculated for mixtures of ethyl, propyl, and *iso*propyl alcohols with water, and is found to be a constant independent of the temperature and of the wave-length of the light used. For ethyl alcohol, the mean value of a is 0·975, for propyl alcohol, 0·92, and for *iso*propyl alcohol, 0·95. Knowing the value of a, the indices of refraction of mixtures of alcohol and water, and the specific gravities and indices of refraction of absolute alcohol and water, the compression of the aqueous alcoholic mixtures can be calculated; results obtained in this way for various mixtures of ethyl alcohol and water at 15°, 20°, and 30° agree closely with the experimental numbers. Calculation of the concentration of mixtures of alcohol and water by means of Gladstone's formula, $(n-1)/d = \text{const.}$, yields accurate results, which are also given by Pulfrich's (*loc. cit.*) modification of Gladstone's formula.

The expansion of liquids by heat is expressed with great accuracy by the equation $v_t = v_0/(1 - kt)$ (compare Mendeléeff, *J. Russ. Phys. Chem. Soc.*, 1884, **16**, 1). The authors find that a similar equation, $n_t = n_0/(1 + kt)$, gives accurately the relation between the index of refraction of a liquid and the temperature; k is termed the modulus of the index of refraction.

T. H. P.

New Law of Series Spectra. W. Ritz (*Physikal. Zeitsch.*, 1908, **9**, 521—529).—A formula is given by means of which new series of spectral lines can be deduced from known series. The newly-discovered series of lines in the spectra of the alkali metals are accurately represented by means of the formula, and it is also shown that the series of lines in the spectra of helium, copper, and the alkaline earth metals are in agreement with it.

H. M. D.

Spectrum of the Lighter Constituents of Air. Herbert E. Watson (*Proc. Roy. Soc.*, 1908, **81**, *A*, 181—194).—The lighter portions of air were separated by fractional distillation by Coates (Abstr., 1907, ii, 257), and the portion not absorbed by charcoal at −190° was further fractionated. One fraction pumped off charcoal at −205°, and a second fraction at −190°, have now been examined spectroscopically by the author. The spectra of the first order, and, for all lines of wave-length less than 4100, of the second order as well, obtained with a Rowland grating, were photographed. A very long exposure was given in order that faint lines might not be overlooked.

The wave-lengths obtained, along with those of Liveing and Dewar (Abstr., 1901, ii, 213) and Baly (Abstr., 1904, ii, 3) for comparison, are given in tabular form. After allowing for the lines ordinarily ascribed to helium and neon (and also to traces of argon and hydrogen), a considerable number of lines remain unaccounted for. These lines, however, do not appear to show more than accidental coincidences with any of the chief nebular or coronal lines, or with any of the lines of the spectrum of the solar chromosphere. It seems probable, therefore, that the majority are really neon lines which were not observed previously owing to insufficient exposure, and there is no evidence that the fractions contain gases other than those already mentioned.

G. S.

Spectrum of Radium Emanation. Alexander T. Cameron and Sir William Ramsay (*Proc. Roy. Soc.*, 1908, **81**, *A*, 210—213).—In a previous paper (Abstr., 1904, ii, 529), Ramsay and Collie gave measurements of the spectrum of radium emanation obtained with a direct-vision spectroscope. The spectrum in question has now been photographed. Three successive photographs were taken, but only the first showed the spectrum of the emanation alone, as the effect of the discharge is to drive the emanation towards the negative electrode, where it is largely absorbed, and the tube soon shows only the hydrogen spectrum.

Much better results were obtained with copper electrodes in place of the aluminium electrodes first used. The former electrodes appear not to contain hydrogen, and absorb the emanation much more slowly than aluminium does.

The wave-lengths and intensities of the lines ascribed to the emanation are given in the paper (compare Rutherford and Royds, following abstract). G. S.

Spectrum of Radium Emanation. ERNEST RUTHERFORD and T. ROYDS (*Phil. Mag.*, 1908, [vi], 16, 313—317. Compare Cameron and Ramsay, preceding abstract).—The spectrum of radium emanation purified as well as possible from permanent gases and carbon dioxide was found to consist of entirely characteristic lines. The authors have mapped a spectrum of seventy-four lines between 3612·2 λ and 6079 λ, thirty-nine lines being observed visually, and sixty-three photographed. None of these lines has been identified in any stellar spectrum.

The colour of the discharge is bluish, the spectrum being characterised by groups of brilliant green and violet lines.

During the passage of the discharge, the emanation lines grow gradually weaker, and the emanation itself appears to be driven into the walls of the tube, whence it is removed with difficulty by strongly heating the glass. After three days, the glass is much blackened, and the principal lines of helium appear in the spectrum. R. J. C.

Quantitative Indications Furnished by Dissociation Spectra: Silver. ANTOINE DE GRAMONT (*Compt. rend.*, 1908, 147, 307—309. Compare Abstr., 1907, ii, 728; this vol., ii, 645).—The following series of argentiferous materials have been examined spectroscopically, employing the simple or oscillating condensed spark: (1) galena; (2) commercial lead; (3) alloys of lead and silver; (4) alloys of tin and silver, all of known composition. Spectra of the four classes have been photographed on the same plate, and to render the quantitative indications comparable, six spectra of each class, representing six different concentrations of silver, have been recorded by vertical movement of the plate. It is found that the number and intensity of the lines for silver have a direct and constant relation to the concentration of the metal in the sample. A table is given showing the lines which disappear at different concentrations of silver from 1% to 0·0001%.

It is necessary to guard against certain foreign lines which coincide with those of silver, and also against the halo occasioned by bright lines of lead or tin. W. O. W.

Apparatus for Producing Coloured Flames. ROBERT GOLDSCHMIDT (*Bull. Soc. chim. Belg.*, 1908, 22, 255—259).—A description and sketch of a simple arrangement for obtaining a flame permanently and intensely coloured.

The air supply of a Bunsen flame is charged with a spray produced by electrolysis of a suitable solution. W. O. W.

Electro-optical Properties of Liquid Mixtures. J. Chaudier (*Ann. Chim. Phys.*, 1908, [viii], 15, 67—140).—The author first gives a résumé of previous work on the changes undergone by light when it traverses a liquid situated in a magnetic field (compare Majorana, *Atti. R. Accad. Lincei*, 1902, 11, i, 374, 463, 531; 11, ii, 90, 139; Meslin, Abstr., 1903, ii, 408, 521, 585).

The laws of electric dichroism are shown, theoretically and experimentally, to be similar to those established by Meslin (*loc. cit.*) for magnetic dichroism. But whilst the sign of electric dichroism is independent of the relative value of the dielectric constants of the media, that of magnetic dichroism can be altered by modifying the relative value of the magnetic constants of the solid and surrounding liquid. The dichroism is proportional to the length of liquid traversed by the light and to the concentration of the liquid, and increases with the intensity of the field to a limiting value.

A mixture of liquids placed in a uniform electric field exhibits marked birefraction, provided that the suspended particles are sufficiently minute.

The field due to gravity is also capable of producing the phenomena of dichroism and even of birefraction. The action of any uniform field is hence manifested in an orientation of the particles of mixed active liquids, which then exhibit the phenomena of dichroism and birefraction; the laws of these phenomena are the same whatever the nature of the field, provided that account is taken of the change of sign due to diamagnetism. If the particles in suspension have a greater magnitude than about 0·3 mm., dichroism alone is observed, and is due to the reflection of light by the crystalline surfaces. If the particles are smaller and uniform in size, dichroism is still the principal phenomenon observed, but birefraction also appears, and the modifications due to diffraction come into play. As the dimensions of the particles diminish, dichroism becomes rarer, and birefraction plays a more important rôle, whilst, when they are infinitely small, as in colloidal solutions, the phenomena of reflection and refraction are no longer produced and the liquids are only birefractive. T. H. P.

Electrochemistry of Light. III. Halogen Carriers. Wilder D. Bancroft (*J. Physical Chem.*, 1908, 12, 417—447. Compare this vol., ii, 448, 549).—The facts and theories relating to the action of carriers in the chlorination and bromination of hydrocarbons are discussed, and a new theory is put forward which resembles in some respects that advanced by Bruner (this vol., i, 146).

The chief conclusions at which the author arrives are that the action of halogen carriers is not due to the intermediate formation of additive compounds, and that under suitable conditions the carriers react with the hydrocarbons even in the absence of free halogen.

To account for the observed facts of substitution in the side-chain and in the nucleus, it is supposed that the halogens and the carriers give rise to ions, and that substitution takes place in the nucleus when the negative ions are present in excess and in the side-chain when the positive ions predominate. By means of this theory, the catalytic action of ferric, stannic, and aluminium chlorides, as well as of iodine monochloride, phosphorus pentachloride, water, and sunlight, can be accounted for. The facts relating to the velocity of the reactions when certain of these carriers are employed can also be explained.

H. M. D.

Photographic Action of Metals and Hydrogen Peroxide (So-called Metallic Radiation). SEM SAELAND (*Ann. Physik*, 1908, [iv], 26, 899—917. Compare Russell, Abstr., 1898, ii, 287; 1899, ii, 720).—An investigation has been made of the conditions under which photographic action is produced by certain metals and by solutions of hydrogen peroxide, and from the results the author concludes that the action of the metals is due to chemical changes and not to the emission of any special type of radiation.

The activity of the metals, measured immediately after polishing the surface, increases with the electropositive character, and the greater the activity of the freshly-polished metal the more rapidly does this activity diminish with time. When the metal is kept in a vacuum, this diminution in the activity does not take place. The photographic activity is also unaltered after the metals have been heated, and exposure to an electrical field has no influence on the photographic effect. The darkening of the plates is greatly increased if the plates are left undeveloped for some time, or if before developing they are gently heated.

In a vacuum containing phosphoric oxide, the photographic action does not take place; conditions under which hydrogen peroxide can be formed appear to be essential. Experiments are also described which indicate that the action does not spread from the active metals in a rectilinear manner, but that, on the other hand, the distribution is such as would be expected if gaseous diffusion were taking place. The photographic action is not observed when certain metals, such as copper, or alloys, like brass, are interposed as diaphragms between the active metals and the photographic plate. It is also inhibited if very thin, non-porous sheets of metals are interposed, or if a sufficiently rapid current of air is passed between the photographic plate and the active metal.

The observations indicate the identity of the action of metals and of hydrogen peroxide solutions. The metals therefore exhibit photographic activity in consequence of the formation of hydrogen peroxide, and are only active when the conditions are such that hydrogen peroxide can be produced.

H. M. D.

Relation of Absorption and Sensitiveness in Photographic Preparations. ERICH LEHMANN (*Zeitsch. physikal. Chem.*, 1908, 64, 89—119).—The question as to the influence of wave-length on the relation of optical absorption to photochemical extinction has not hitherto received a definite answer. The author shows that in the case of silver iodide a solution of the problem is possible. For silver iodide either by itself or in collodion, the maximum of absorption and the maximum of sensitiveness are coincident. In a gelatin emulsion of silver iodide, however, the maximum of sensitiveness is displaced

$16 \cdot 65 \mu\mu$ relatively to the absorption maximum. This may be due to the formation of an organic silver salt.

It is exceedingly probable that similar results would be obtained with silver chloride and bromide if these substances could be subjected to direct observation. J. C. P.

Photochemical Oxidation of Hydrogen Iodide by Oxygen. JOH. PLOTNIKOFF (*Zeitsch. physikal. Chem.*, 1908, **64**, 215—228. Compare Abstr., 1907, ii, 212).—The rate of decrease of the oxygen concentration is now found to be proportional to the 2/3 power of the acid concentration both in the light and in the dark. The fact that in the earlier work different values were found for the exponent of the hydrochloric acid concentration in the light and in the dark was probably due to some catalytic agent, and it is now shown that the presence of copper sulphate is sufficient to cause such a difference.

For the reaction in the dark, the value of K_{T+10}/K_T is now found to be 2·07 ; for the reaction in the light the value is 1·38.

The author's further experiments show that the photochemical oxidation of hydrogen iodide by oxygen is the sum of two independent changes: (1) the reaction in the dark; (2) the reaction in the light. Hence the velocity may be represented by the formula: $-d(O_2)/dt = [K_d . 10^{\alpha T} + K_l . I . 10^{\beta T}](HCl)^{\frac{2}{3}}(KI)^{\frac{2}{3}}(O_2)$. J. C. P.

Method of Carbon Dioxide Assimilation. EMIL BAUR (*Zeitsch. physikal. Chem.*, 1908, **63**, 683—710).—A solution of potassium ferric oxalate in diffused daylight evolves carbon dioxide, but the evolution of gas ceases before all the ferric salt is decomposed. When a solution of potassium ferrous oxalate is kept in an atmosphere of carbon dioxide, the gas is gradually absorbed, and ferric salt is produced. These observations may be summed up in the equation: $Fe(C_2O_4)_3K_3 \rightleftharpoons Fe(C_2O_4)_2K_2 + \frac{1}{2}C_2O_4K_2 + CO_2$.

The reversibility of this reaction has led the author to consider the suggestion, that in the original production of organic compounds the reduction of carbon dioxide to oxalic acid was the first stage. In order to make the energy of light available for this reduction, the system ferrous oxalate + ferric oxalate + carbon dioxide must be combined with a system in which oxygen is developed under the influence of light. This latter result is attained, for instance, when silver chloride immersed in water is exposed to light, and the author shows how in a vessel provided with a septum of photochloride and a semipermeable membrane it would be possible, theoretically at least, to effect the conversion of carbon dioxide and water into oxalic acid and oxygen. In endeavouring to find other systems which, like silver chloride in water, would evolve oxygen on exposure to light, the author has studied the way in which the potentials of iron, mercury, uranium, and cerium salts are affected by light. The *P.D.* at a platinum electrode immersed in a solution containing both uranous and uranyl salts is actually less positive when exposed to sunlight than when kept in the dark. The displacement of potential is considerable, and takes place more or less rapidly according to the nature of the salts employed. The results obtained with iron, mercury, and cerium salts were less noteworthy.

The term "light content" ("Lichtinhalt") is proposed for the quantity of energy which is absorbed by a light-sensitive substance, and which goes to change its chemical potential. The value of this "light content" is deduced from the *E.M.F.* of photoelectric cells and their temperature-coffiecients. J. C. P.

Distribution of the Radiation from Radioactive Substances. Heinrich W. Schmidt (*Physikal. Zeitsch.*, 1908, 9, 537—541).—To explain the irregular distribution of the radiation from substances containing uranium, which Greinacher (this vol., ii, 551) found on examination of photographic plates which had been placed in contact with these substances cut into sections of well-defined geometrical forms, it is not necessary to attribute the action to secondary rays. The phenomenon can be referred to the action of the β-rays if it is assumed that the emitted rays follow the cosine law of Lambert. Conversely, the experimental observations indicate the validity of this law in the case of corpuscular radiation. H. M. D.

Experiments with Radium Emanation. Volume of the Emanation. Ernest Rutherford (*Phil. Mag.*, 1908, 16, 300—312). —The amount of emanation in equilibrium with one gram of radium is q/λ, where q is the rate of production per second and λ is the radioactive constant of the emanation. The value of λ is about 1/468000.

Assuming that one atom of radium emits one α-particle and then becomes one atom of emanation, and knowing the number of α-particles emitted per second and the charge on each (Rutherford and Geiger, this vol., ii, 794), the author calculates the volume of the emanation to be 0·57 cub. mm. per gram of radium. Ramsay and Cameron, however (Trans., 1907, 91, 1266), obtained 7·07 cub. mm. of emanation from one gram of radium. The author finds that probably 80% of the gas measured by these authors consisted of matter foreign to the emanation itself.

To obtain pure emanation, radium bromide was either heated in a quartz tube or dissolved in water, the emanation being pumped off with the oxygen and hydrogen formed, and sparked down as described by Ramsay. The emanation was collected over potassium hydroxide, and condensed by cooling in liquid air. After all uncondensed gases had been pumped off, the emanation was allowed to gasify and remain some hours in contact with potassium hydroxide. It was finally liquefied again by liquid pentane at a temperature between 150° and 186° and exhausted by the pump, a portion being volatilised and lost in the process. Difficulty was experienced in obtaining the emanation free from carbon dioxide, although phosphoric oxide was used to lubricate the stopcocks and the emanation frequently stood twenty-four hours over potassium hydroxide. The emanation, as finally measured in a capillary tube, was in such a state of purity that the spectrum of carbon dioxide was hardly seen, but a new spectrum of bright lines certainly due to the emanation itself appeared.

The amount of radium corresponding with the amount of emanation measured was estimated by comparing the γ-ray activity of the emanation with that of a standard sample of radium bromide. When the emanation was well purified, its volume varied from 0·80 to 1·32 cub. mm. per gram of radium, decreasing rapidly and spontaneously to 0·58 to 0·66 cub. mm. The average final volume corrected for temperature and pressure was 0·58 cub. mm. The highly-purified emanation had the usual half-period of 3·75 days, and the author finds it difficult to explain the spontaneous contraction. In one experiment when purified emanation was left eleven days in the capillary, its volume greatly increased again, and a brilliant spectrum was obtained showing all the lines of helium. Passage of electric sparks caused the emanation to condense on the glass walls of the capillary, leaving only carbon dioxide. At the temperature of liquid air, the emanation has a sensible vapour pressure. R. J. C.

Relative Activity of Emanation and Active Deposit from Thorium and from Actinium. Howard L. Bronson (*Phil. Mag.*, 1908, [vi], **16**, 291—299).—It is frequently assumed that each atom of the various radioactive substances gives off either one or no α-particle each time it undergoes transformation. The author's comparisons of the relative activity of emanation and active deposit in the cases of thorium and actinium, making due allowance for the different mean free paths of the α-particles in the various cases, fail to support this view.

A quantity of the volatile radioactive products from thorium or actinium was conveyed to the testing vessel by a current of air, and its total ionising activity was measured. After waiting a short time to allow the emanation to decay, the residual ionising activity due to the active deposit was measured. The activity of the emanation was obtained by difference. Knowing the rates of transformation of all the products, the activity of the deposit when at its maximum value could be calculated.

The ratio of ionisation due to active deposit to that due to emanation was found to vary from 0·34 to 0·40 in the case of thorium, and from 0·28 to 0·41 with actinium, different ratios being obtained with measuring vessels of different sizes.

The active deposit from thorium is supposed to contain thorium *B* and thorium *C*. In all cases with thorium, the calculated ionisation ratio was four times as great as the measured ratio, whilst with actinium the calculated ratio was always twice as great as the measured. The presence of other substances of short transformation periods would serve to explain the results, but there is no evidence for this (compare Hahn, Abstr., 1906, ii, 718). The author prefers to suppose that atoms of thorium *B* and thorium *C* give off the same number of α-particles during transformation, but that an atom of thorium emanation gives off four times as many; also, that a disintegrating atom of actinium emanation gives off twice as many α-particles as an atom of its active deposit. On the other hand, radium emanation, radium *A*, and radium *C* appear to give off the same number of α-particles per atom. The actual number of ejected α-particles per atom cannot be stated as the determinations are only relative. R. J. C.

Ozonisation of Air by the Action of Radium Salts and Emanation. Raffaelo Nasini and Mario G. Levi (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 46—49).—The authors discuss the formation of ozone by radium salts, which is affirmed by Madame Curie and by Giesel, but denied by Ramsay and by Soddy. The authors' experiments show that, in presence of a large excess of air or oxygen, ozone is formed by the action of radium.

A small bottle containing 0·005 gram of radium bromide dissolved in 30 c.c. of water was placed open in a 5-litre flask containing air. When the flask was closed by a ground-glass stopper, after some hours the air inside gave the reactions of ozone, but if a cork or a rubber stopper was used, the air gave no odour or reactions of ozone, which had been destroyed.

Further experiments indicate that the emanation itself cannot produce ozone, but the results cannot be regarded as absolutely decisive. T. H. P.

Action of Radium Emanation on Solutions of Copper Salts. Madame Marie Curie and Mlle. Gleditsch (*Compt. rend.*, 1908, **147**, 345—349).—The authors have repeated Cameron and Ramsay's experiments (Trans., 1907, **91**, 1593) on the action of radium emanation on copper salts, taking special precautions to employ apparatus and reagents free from traces of lithium. Platinum vessels were used, since it was found that distilled water free from lithium becomes contaminated with traces of this element when allowed to remain in contact with glass for twenty-four hours. The use of quartz vessels, especially of the transparent variety, is inadmissible, since these contain notable amounts of lithium. The water and acids necessary were distilled in platinum retorts, and the reagents were not allowed to come into contact with glass during the experiments. It was found practically impossible to remove the last traces of lithium from copper sulphate. After allowing the emanation to act on the solution, the copper was removed, and, after evaporation of the liquid, the residue, which weighed about 0·0004 gram, was examined spectroscopically. Sodium and potassium were found to be present, but lithium could not be detected. Comparative experiments on sodium sulphate containing known quantities of lithium sulphate indicated that the residue could not have contained more than $0·6 \times 10^{-5}$ milligram lithium. In order to show that no lithium was lost during the experiment, a control experiment was carried out on a solution containing 0·27 gram of copper and an amount of lithium sulphate equivalent to $1·7 \times 10^{-4}$ milligram of the chloride. After removal of the copper, lithium was readily detected in the residue.

The authors consider that the formation of sodium and lithium has not been established by Cameron and Ramsay. W. O. W.

Retardation of α-Rays by Metal Foils, and its Variation with the Speed of the α-Particles. T. Smith Taylor (*Amer. J. Sci.*, 1908, [iv], **26**, 169—179).—In the experiments of Bragg and

Kleeman, and also in those of Kučera and Mašek (Abstr., 1907, ii, 4), McClung (Abstr., 1906, ii, 138), Rutherford (Abstr., 1906, ii, 642), and Levin (Abstr., 1906, ii, 595), on the effect produced on the range of α-particles by the interposition of sheets of metals, the air equivalents corresponding with different positions of the screen were obtained by determining the difference of the range with the source of the rays uncovered and with the screen in place. As this method is not very accurate, a new method has been devised, and is described in the present paper.

Polonium was used as the source of the rays, and experiments were made with thin sheets of gold, lead, tin, aluminium, and silver of varying thickness. The results show that the air equivalents of sheets of metal foil decrease with the range, and hence with the speed, of the α-particles. The change is very small for thin foil of the lighter metals when the range of the α-particles is high, but for thicker sheets or a lower range, the change is more considerable. A comparison of the change for sheets of different metals of nearly equal air equivalents shows that the rate of change is in the order of the atomic weights of the metals. E. G.

Charge and Nature of the α-Particle. Ernest Rutherford and Hans Geiger (*Proc. Roy. Soc.*, 1908, **81**, *A*, 162—173. Compare this vol., ii, 555).—The total charge carried by the α-particles expelled per second from a known weight of radium has been determined directly, and from the result and the number of α-particles expelled per second per gram of radium, the charge carried by an α-particle has been calculated as $9{\cdot}3 \times 10^{-10}$ E.S. units. In determining the total charge carried by the particles, radium *C* was used as a source of radiation; the particles passed through aluminium plates into a testing chamber, and the current was measured in the usual way. The methods used to eliminate other rays, and to determine the strength of the radiating source, are fully described.

The charge carried by an α-particle, calculated on the assumption that the heating effect of radium is a measure of the kinetic energy of the α-particles expelled from it, is $9{\cdot}1 \times 10^{-10}$ E.S. units, in good agreement with the above value. The charge *e* carried by a hydrogen atom has been estimated by J. J. Thomson, H. A. Wilson, and others at $3—4 \times 10^{-10}$ E.S. units, from which it would follow that the charge on the α-particle is between 2*e* and 3*e*. Reasons are given for the assumption that the values hitherto found for *e* are too low. As the α-particle probably carries 2*e*, the most probable value for *e* is $4{\cdot}65 \times 10^{-10}$ E.S. units. Support is lent to this view by a new calculation of *e* from the known period of transformation of radium, the result obtained being $4{\cdot}1 \times 10^{-10}$ E.S. units.

As the ratio of the charge on the α-particle to its mass has already been determined, the mass (atomic weight) of the α-particle has now been calculated as 3·84, which supports Rutherford's previous suggestion that the α-particle, after it has lost its positive charge, is a helium atom.

From the data now available, some important radioactive magnitudes, such as the volume of the emanation and the rate of production of helium, have been calculated. G. S.

Scattering of the α-Particles by Matter. HANS GEIGER (*Proc. Roy. Soc.*, 1908, **81**, *A*, 174—177).—Radium emanation was employed as a source of α-particles; these were allowed to pass through a narrow slit on their way to a phosphorescent screen, and from a comparison of the area reached by the rays (as determined by observing the scintillations) with the magnitude of the geometrical image of the slit, the amount of scattering could be ascertained.

In a vacuum, scarcely any scintillations were observed outside the image of the slit, but, when air was allowed to enter, the area of scintillation increased. The same effect was produced in a vacuum when the slit was covered with gold leaf, and to a smaller extent when aluminium foil was employed. G. S.

Secondary γ-Rays due to γ-Rays of Radium C. A. S. EVE (*Phil. Mag.*, 1908, [vi], **16**, 224—234).—The intensity of secondary cathode radiation from various substances under the impact of Röntgen rays, β-rays, and γ-rays has been shown to be a function of the atomic weight of the secondary radiator, but comparison of Townsend's determinations of secondary radiation, from various substances under the influence of *X*-rays, with the author's values for the total secondary radiation produced by γ-rays, reveals striking discrepancies. The author has endeavoured to find the origin of these differences, which, if Röntgen rays and γ-rays are fundamentally of the same nature, ought not to arise.

Upwards of 30% of the secondary radiation may consist of secondary γ-rays with a penetrating power equal to that of primary γ-rays from actinium, but greater than that of primary γ-rays from uranium or radium. One or two millimetres of lead or aluminium suffice to absorb completely the secondary cathode rays from lead, iron, or brick radiators, but allow the secondary γ-rays to pass. When comparative experiments are made in such a way that cathode secondary rays are absorbed and only secondary γ-rays reach the electroscope, the secondary effects produced by *X*-rays and γ-rays of radium are neither in order of the atomic weights nor of the densities of the radiators, and are not in agreement with one another. The secondary rays which reach the electroscope are γ-rays, and not penetrating cathode rays, since their intensity is not affected by a strong magnetic field.

The differences apparently lie more in the velocity than in the nature of the particles. Even cathode secondary radiation, which follows the order of the atomic weights, has a much higher velocity when excited by β- or γ-rays than by *X*-rays. The similarity of the β- and γ-ray effects in this instance is held to support Bragg's theory that β- and γ-particles are essentially the same, but bear different charges.

The intensity of the secondary γ-rays induced by primary γ-rays from radium depends on the material surrounding the radium. Primary γ-rays traverse steel more readily than lead, but rays which have passed through steel are more readily absorbed by lead than rays which have already passed through lead. Taking the case of radium enclosed in a glass tube, the secondary radiation due to γ-radiation is 7·5% of that due to β- and γ-radiation together. Of this 7·5%, the larger part is cathode secondary radiation, the proportion of γ-radiation in it being 6·2% from lead, 25% from iron, and 28% from brick.

The coefficient of absorption of primary γ-rays from radium is 0·45—0·57, from uranium 1·4, from actinium 2·7—4·7, whilst the secondary γ-rays excited by radium γ-rays in lead, iron, and brick have a coefficient about 4·6. The author is of the opinion that secondary γ-rays caused by the primary γ-rays of actinium would have a coefficient of absorption even lower than 4·6, and approximating to that of *X*-rays. R. J. C.

Polonium Rays. CH. LATTÈS (*Chem. Zentr.*, 1908, i, 2137—2138; from *Le Radium*, 1908, 5, 97—102).—The author has endeavoured to obtain evidence of the production of secondary rays when polonium rays fall upon a metal plate by means of delicate electrical and photographic processes. In this he has been unsuccessful, although it is probable that secondary rays are produced (Logeman, Abstr., 1906, ii, 721), and should be photographically detectable. J. V. E.

Radioactivity of Certain Goitrigenic Springs. RÉPIN (*Compt. rend.*, 1908, **147**, 387—388).—Three samples of spring water from the neighbourhood of St. Jean de Maurienne were found to be distinctly radioactive ($A = 0·011$ to 0·031 in Curie-Laborde units). Endemic goitre is known to be prevalent in the districts where these waters are used for drinking purposes, and the author suggests that the well-known disappearance of goitrigenic properties which takes place after the lapse of time is connected with the decay in the radioactivity of the waters. W. O. W.

Invisible Radiations from the Explosive Discharge in Air. I. SCHINCAGLIA (*Nuovo Cim.*, 1908, [v], **15**, 481—491).—An apparatus is described which allows of the very accurate regulation of a spark gap, in order to study the effect of radiations from another spark in causing the spark to pass. The transparency of various liquids to the invisible rays was examined by enclosing them in a quartz or selenite cell and interposing them between the spark gaps.

Whilst water and alcohol are transparent, metallic salts and many organic liquids, such as turpentine, carbon disulphide, and petroleum, are highly opaque, indicating that the radiation from the spark does not contain extreme ultra-violet rays. C. H. D.

Radiation from Drying Oils. WERNER SCHMIDT (*Zeitsch. physikal. Chem.*, 1908, **64**, 243—250).—Gum arabic when kept in the neighbourhood of linseed-oil varnish is found to undergo a slow change and becomes insoluble. If a gum solution contains a little chromate, the gum is rendered insoluble, rapidly when exposed to light, and more slowly when exposed to linseed-oil varnish in a dark room. This analogy between the action of light and the action of the drying oil is borne out by a study of the effect of the latter on a photographic plate. The radiation from the oil affects the plate even through slips of gelatin or paper, and if a perforated sheet of metal is interposed, an image is obtained. The phenomenon of solarisation has also been observed.

This behaviour of linseed-oil varnish is connected with the oxidation which goes on during drying, and which is possibly accompanied by the formation of ozone or other compounds of a superoxide character. It has been noticed that the bright surface of a metal plate exposed in the neighbourhood of a linseed-oil varnish shows evidence of oxidation.

J. C. P.

Formation of Mists in Presence of Radium Emanation. Madame Marie Curie (*Compt. rend.*, 1908, **147**, 379—382. Compare this vol., ii, 7).—The appearance of mists in moist gases induced by radium emanation appears to be due to the formation in the gases of chemical compounds capable of absorbing water vapour. The gases experimented on were contained in sealed glass bulbs illuminated by the electric arc. Air containing pure water vapour and charged with emanation gives a slight mist, persisting for several days; a mist is not produced when the air is replaced by carbon dioxide. If the water contains half its weight of sulphuric acid, an intense mist, lasting for several months, is produced whether the gas employed is air or carbon dioxide.

A permanent mist is also obtained in a bulb containing concentrated sulphuric acid and carbon dioxide; in a blank experiment without emanation, a still more intense mist was produced on warming the bulb, but this disappeared in less than a day. When caoutchouc stoppers are used to close the bulbs, the mists are very dense and persistent, probably through the oxidation of sulphur and organic matter giving rise to products capable of acting as centres of condensation. This is confirmed by the production of a fine, persistent mist in a bulb containing water, air, and emanation, with a fragment of sulphur kept out of contact with the water; at the end of the experiment, sulphuric acid is present in the water. The presence of nitric acid has also been detected when air has been used.

Similar mists are formed in air charged with light petroleum or carbon disulphide, and also in carbon dioxide containing anhydrous ether with emanation. In some instances, mists are formed when solids are employed; in these cases, a deposit is visible on the sides of the vessel. Emanation induces a mist in carbon dioxide containing iodine, or in air containing camphor; in the first instance, the mist subsides in a few days. Actinium causes a mist in moist carbon dioxide.

The drops constituting the mist in the foregoing experiments behave as if they had no electrostatic charge when introduced into an electric field.

W. O. W.

Supersaturation and Nuclear Condensation of Certain Organic Vapours. T. H. Laby (*Phil. Trans.*, 1908, *A*, **208**, 445—474; *Proc. Roy. Soc.*, 1908, **81**, *A*, 219—220).—Dust-free air, saturated with an organic vapour (ester, acid, or alcohol), was subjected to sudden adiabatic expansion in a special apparatus, and the least expansion required to produce condensation of the vapour noted. The effect of the presence of ionic nuclei, obtained by previous exposure to Röntgen rays, on the conditions of condensation was also noted, as well as the different effects produced according as positive or negative ions were in excess.

The degree of supersaturation, S, existing at the end of the expansion has been calculated for a number of alcohols, esters, and acids; it is greatest for the acids and least for the alcohols. There is good agreement in some cases between the values of S deduced from the expansions and those calculated on the accepted theory of condensation on ionic nuclei.

In the case of certain acids, greater expansion is necessary to produce condensation in the absence of ionic nuclei than when they are present. The positive ions are more efficient condensing agents than the negative for certain organic vapours, but water condenses more easily on negative ions.

Certain organic compounds, including alcohols and esters, become negatively charged when air is bubbled through them, but acetic acid becomes positively charged. G. S.

Influence of Traces of Nitrous Gases on the Condensation of Water Vapour. Erich Pringal (*Ann. Physik*, 1908, [iv], 26, 727—750).—The object of the experiments was to determine whether the condensing action of ordinary ozonised oxygen or air on water vapour is due to the presence of small quantities of nitrous gases. The experimental observations show that this is the case, and that pure ozone has no condensing action. In presence of water vapour, ozone appears to act on nitrogen and yield the condensation agent. Attention is called to the importance of these observations in connexion with the condensation of atmospheric water vapour. H. M. D.

Genesis of Ions by Collision of Positive and Negative Ions in a Gas. Experiments on Argon and Helium. E. W. B. Gill and F. B. Pidduck (*Phil. Mag.*, 1908, [vi], 16, 280—290).—Townsend and Hurst (Abstr., 1905, ii, 7), assuming that positive and negative ions produce ionisation of a gas at definite rates, deduced an equation connecting gaseous conductivity and sparking potential with the gap between the electrodes. The authors have determined the minimum voltage required to produce a spark in argon or helium and the conductivity at various pressures in order to test the above theorem.

Each negative ion is supposed to produce a gaseous ions, and each positive ion β gaseous ions, in moving through a centimetre. Experiments were carried out with gaseous pressures of 0·66 mm. to 13 mm. and various distances between the electrodes. The values of the constants a and β at any one pressure could be calculated from three conductivity measurements. The remaining conductivities at this pressure were found to be in satisfactory agreement with Townsend and Hurst's equation. Additional support for the theory is found in the extremely close agreement between the sparking potentials determined directly in argon and helium and the potentials calculated from conductivity measurements at lower potentials. The values of the constants a and β for argon are greater than for air, so that argon is more readily ionised than air by both positive and negative ions. The helium employed was somewhat impure, but as the theory holds equally well for mixtures, values of α and β could be calculated. Even impure helium is more readily ionised than hydrogen, and, after purification by charcoal cooled in liquid air, the sparking potential of helium was lowered (compare Strutt, *Trans. Roy. Soc.*, 1900, *A*, **193**, 377). On the other hand, purification of the argon employed did not affect the values obtained with it.

After the passage of one spark, a higher potential was required to pass another immediately. Passing a spark in the reverse direction facilitated recovery. This effect may be due to some kind of polarisation at the zinc electrodes. R. J. C.

Positive Electrons. A. Bestelmeyer (*Physikal. Zeitsch.*, 1908, **9**, 541—542).—It has been found by J. Becquerel (this vol., ii, 751) that canal rays which are caused to pass through a small opening through which cathode rays are also passing are displaced in the immediate neighbourhood of the aperture under the influence of a magnetic field. Becquerel's conclusion, that the canal rays are temporarily transformed into positively-charged carriers as the result of contact with the cathode rays, is refuted by the author. The phenomenon can be satisfactorily explained by the electrostatic charge which the walls of the aperture receives as the result of bombardment by the cathode rays. In consequence of the action of this electrostatic charge, the canal rays are caused to deviate from their rectilinear paths. H. M. D.

Experimental Investigation of the Stratified Positive Glow. R. Holm (*Physikal. Zeitsch.*, 1908, **9**, 558—562).—Measurements have been made of the potential gradient and the distance between adjacent strata of the positive glow in the discharge through hydrogen, nitrogen, and helium. Curves are plotted which show the dependence of these two factors on the current intensity. Almost identical results are obtained whether the method of Stark or that of H. A. Wilson is employed. H. M. D.

Cathodic Volatilisation of Metals in Attenuated Gases. Volkmar Kohlschütter (*Zeitsch. Elektrochem.*, 1908, **14**, 417—421). —Fischer and Hähnel (this vol., ii, 653) have found that the volatilisation of a metal is the same in argon and hydrogen when the same current is used, whereas Kohlschütter and Goldschmidt (this vol., ii, 457) found large differences.

The author now shows that the results depend on the kind of current used. Two different induction coils are used: (*A*) a coil with a high resistance primary and low resistance secondary winding, and (*B*) an ordinary Ruhmkorff coil. Using platinum cathodes in tubes filled with hydrogen and argon respectively and connected in series, he finds that the quantity of platinum volatilised in argon is from four to twenty-two times as much as that volatilised in hydrogen.

The ratio of the quantities volatilised in argon and in hydrogen is increased by increasing the pressure of the gas and the current strength when one coil is used, but decreased with the other coil. Hence the results obtained appear to depend entirely on the peculiarities of the induction coil employed. T. E.

Volatilisation of Cathodes in Attenuated Gases. FRANZ FISCHER and OTTO HÄHNEL (*Zeitsch. Elektrochem.*, 1908, **14**, 433—437; VOLKMAR KOHLSCHÜTTER, *ibid.*, 437—439).—These papers contain the numerical data on which the statements already published (this vol., ii, 653) are founded, and a reply by Kohlschütter (compare preceding abstract). T. E.

Electrical Conductivity of Mixtures of Alcohol and Water. ANTONY G. DOROSCHEWSKY and M. S. ROSCHDESTVENSKY (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 887—908).—After discussing previous work on this subject, the authors give the results of their own measurements.

The values obtained for the conductivities of aqueous-alcoholic solutions of various concentrations at 15° are quite different from those given by Pfeiffer (Abstr., 1885, 1029; 1886, 4, 115), as also is the form of the curve connecting the conductivity with the percentage of alcohol by weight. The curve obtained by the authors not only exhibits no evidence of the existence of definite hydrates of alcohol, but has no singular points. In some respects it resembles the curves connecting the composition of aqueous-alcoholic solutions with other properties, such as the specific gravity and boiling point, the curve falling sharply at both ends and remaining almost horizontal in the middle of its course; there is a slight rise corresponding with about 80% of alcohol.

When the concentration of the alcohol is expressed in grams per 100 c.c. of solution, the electrical conductivity follows the law $K_c.c^{\frac{2}{3}} =$ constant.

The electrical conductivities of aqueous solutions of alcohol are directly proportional to the dielectric constants of the solutions, and inversely proportional to their viscosities. T. H. P.

Electrical Conductivity of Liquid Sulphur. ALBERT WIGAND (*Ber. deut. physikal. Ges.*, 1908, **6**, 495—508).—The author has made measurements of the electrical conductivity of liquid sulphur, in order to ascertain whether this is altered under the influence of light. The experiments were suggested by the fact that liquid sulphur, like solid selenium, consists of a mixture of two modifications in equilibrium, and that in the case of selenium, displacement of the equilibrium takes place under the influence of light in the direction of the formation of a larger proportion of the modification which has the greater conductivity. The results are negative, and indicate that the electrical conductivity of the soluble and insoluble forms of sulphur is the same.

Measurements of the conductivity at temperatures ranging from 130° to 446° show that this increases regularly up to 150°, where it reaches a maximum; it then falls, attaining a minimum value between

160° and 170°, above which it increases up to the boiling point. The view is expressed that the measured conductivity is really due to traces of foreign substances which are ionised in the molten sulphur.

H. M. D.

Effect of Concentration on the Temperature of Maximum Electrolytic Conductivity of Weak Electrolytes with Negative Heat of Dissociation. HENRIK WEGELIUS (*Zeitsch. Elektrochem.*, 1908, **14**, 514—518).—Solutions of hypophosphorous acid (H_3PO_2) have a maximum conductivity at 72° for 5·75*N*., 54° for 1·25*N*., 52° for 0·995*N*., 70° for 0·328*N*., 87·5° for 0·12*N*. With weaker solutions, the temperature of maximum conductivity is higher than 100°. Phosphoric acid gave maxima at 77° for 2·715*N*., 70° for 1·955*N*., and at 79° for 0·217*N*.; weaker and stronger solutions showed no maximum at temperatures below 93°. An approximate theory showing how the temperature of maximum conductivity depends on the changes of dissociation and of ionic mobility with the temperature is given.

T. E.

A New Primary Voltaic Cell of the Daniell Type. JAMES STRACHAN (*Chem. News*, 1908, **98**, 102).—The cell consists of an outer jar in which are placed a number of carbon rods connected by a leaden cover, through which passes a porous pot containing an amalgamated zinc rod immersed in a hydrochloric acid solution of zinc and ammonium chlorides. The outer jar contains an acid solution of lead tetrachloride prepared by dissolving freshly-precipitated lead peroxide in cold concentrated hydrochloric acid, or by adding concentrated hydrochloric acid to a mixture of lead acetate and bleaching powder contained in a pressure bottle and rapidly sealing the latter. Such a solution acts as a rapid depolariser, and is constant in its action; the cell has a higher *E.M.F.*, but a much lower resistance, than a Daniell cell. The disadvantage of the cell due to the escape of chlorine may be overcome by sealing the space between the leaden cover and the porous pot with paraffin wax. The zinc may be replaced by iron, but the *E.M.F.* drops then from 1·5 to 0·95.

P. H.

Gas Electrodes. I. Nitric Oxide. UGO GRASSI (*Nuovo Cim.*, 1908, [v], **15**, 467—480).—The potential of a platinised platinum electrode, saturated with nitric oxide, was measured against a normal calomel electrode. In acid solutions, the electrode is stable, and its potential is independent of the rate of passage of the gas; in alkaline solutions the difference of potential changes sign in the first minute, and only attains its final value slowly. This is due to the conversion of the oxide into alkali nitrite and nitrous oxide, which is greatly accelerated by platinum. The first stage of the reaction is the formation of sodium nitrohydroxylamate: $2NO + Na_2O = ON\dot{:}N(ONa)_2$, which then decomposes according to the equation $2Na_2N_2O_3 + H_2O = 2NaNO_2 + 2NaOH + N_2O$. Quantitative experiments show that the nitric oxide reacts in solution as a double molecule. In acid solutions, the cell $H-(NO)'_2-NO$ has an *E.M.F.* of 0·80 volt, nitric oxide being positive to hydrogen.

C. H. D.

Potential of a Hydrogen Electrode in Acid and Alkaline Solutions. C. L. A. Schmidt and C. P. Finger (*J. Physical Chem.*, 1908, 12, 406—416).—The authors have measured the potential of a hydrogen electrode in a series of solutions, each containing 0·25 gram-atom of boron per litre and prepared by mixing solutions of boric acid and borax or sodium hydroxide in different proportions. From the values of the potential difference, the hydrogen-ion concentrations are calculated, and a series of readily reproducible standards for the colorimetric determination of the strengths of acids and bases has been provided.

From the form of the curve, which is obtained by plotting the potential differences against the percentage amount of the hydrogen of the boric acid which is replaced by sodium, the conclusion is drawn that the compound NaH_2BO_3 (or its anhydride, $NaBO_2$) is the only one formed to any appreciable extent when solutions of boric acid and sodium hydroxide are mixed. This conclusion is in agreement with the results of thermochemical and freezing-point measurements.

H. M. D.

Solid Electrolytes. Their Decomposition by a Current and their Electromotive Properties in Galvanic Chains. Fritz Haber (*Ann. Physik*, 1908, [iv], 26, 927—973).—Part of this paper represents a summary of work which has been published in detail previously (compare Haber and Tolloczko, Abstr., 1904, ii, 813; Haber and Moser, Abstr., 1905, ii, 667; Haber and Foster, Abstr., 1907, ii, 66; Haber and Fleischmann, Abstr., 1907, ii, 6; Haber, Rieff, and Vogt, this vol., ii, 254).

In the third section [with G. Birstein], experiments on the electrolytic decomposition of solid salts of the alkali metals are described. Pure potassium chloride yields at the cathode a violet substance which dissolves in water with evolution of hydrogen. It is not acted on by anhydrous ethyl alcohol. The eutectic mixture of potassium and sodium chloride yields a yellowish-brown substance with the same properties. On electrolysing a mixture of sodium chloride and carbonate, carbon separates at the cathode. Potential measurements are recorded which support the view that the coloured substances formed at the cathode are sub-chlorides of the alkali metals.

The last section of the paper [with R. Beutner] deals with the potential differences at the surfaces of contact of solid electrolytes and of solid salts and their saturated solutions. Application is made of Nernst's theory of potential differences to the special systems under investigation, and a number of theoretical deductions are made.

H. M. D.

Explanation of Supertension. Erich Müller (*Zeitsch. Electrochem.*, 1908, 14, 429—433. Compare Kaufler, Abstr., 1907, ii, 924, and this vol., ii, 558).—Polemical. T. E.

Electrolytic Properties of Dilute Solutions of Sulphuric Acid. W. C. Dampier Whetham and H. H. Paine (*Proc. Roy. Soc.*, 1908, 81, *A*, 58—80. Compare Abstr., 1906, ii, 69).—It has been shown in a previous paper that the progressive diminution in the equivalent conductivity of dilute sulphuric acid with dilution when the concentration is less than 0·0005—0·001 gram-equivalent per litre is still observed when the solvent is boiled repeatedly under low pressure and the air re-admitted through potash bulbs (to remove carbon dioxide), and it is now shown that the diminution in question persists when the air is re-admitted through bulbs containing dilute sulphuric acid and potassium hydroxide respectively.

The observed diminution in the equivalent conductivity could be accounted for if the $H^{\cdot}$ ion travels more slowly in dilute than in concentrated solutions, and to test this point the transport ratio of solutions of different concentration has been determined by a modification of the ordinary method, the changes in concentration round the electrodes due to electrolysis being determined by measuring the conductivity of the solution; in the case of the very dilute solutions, with pairs of electrodes placed in the anode and cathode compartments respectively. Although a change in the expected direction was actually observed, the transport ratio apparently increasing from 0·186 to 0·202 on progressive dilution, it is not considered probable that this is due to a change in the relative migration velocity of the ions, but to some alkaline or saline impurity in the water. As the effect in question is not removed by boiling, the impurity might be ammonium carbonate, but the matter is not regarded as being finally settled.

G. S.

Electrolysis of Copper Solutions. Jean Meyer (*Bull. Soc. chim. Belg.*, 1908, **22**, 259—291).—The author attempts to find a more satisfactory explanation of the anomalous behaviour of the copper voltameter than that provided by the theories of Foerster, Abel, and others. The Foerster-Seidel theory requires that a gram-molecule of cuprous oxide for each 2 × 96540 coulombs should be formed on electrolysing a hot solution of copper sulphate at a lower potential than that required for the deposition of copper; on repeating these authors' experiments, however, it was found that the weight of the oxide was less than half this. Similar results were obtained when operating in absence of air, hence the deficit cannot be due to oxidation to copper sulphate. When the electrolysis is carried out at 90°, a green basic salt of variable composition is precipitated; this compound, which appears to be identical with that obtained by boiling an aqueous solution of copper sulphate, probably arises from dissolution of the cuprous oxide in the copper sulphate solution. This secondary dissolution of the oxide, which is independent of the current and the concentration of the ions, explains the presence of a cuprous salt, and evidence is adduced to show that it accounts for the formation of cuprous oxide at both electrodes. At the cathode, the following reaction is supposed to occur: $Cu + CuSO_4 + H_2O \rightleftharpoons Cu_2O + H_2SO_4$. The same principle is applied to cover the phenomena observed when solutions of cupric chloride are electrolysed.

It was found possible to estimate the amount of cuprous oxide in the metallic deposits by treating the mixture with a neutral solution of ferric alum, which, after being acidified with sulphuric acid, was titrated by permanganate.

It is pointed out that Bose's phenomenon cannot be due to the partial discharge of cupric ions: $\overset{++}{\mathrm{Cu}} \longrightarrow \overset{+}{\mathrm{Cu}}$, as Abel has suggested, since, by electrolysing a hot acid solution of copper sulphate in absence of oxygen and operating with currents of low density, a good yield of pure copper is obtained, the dissolution of copper in copper sulphate solution being accomplished as readily in acid as in neutral solution (compare Heiberg, Abstr., 1903, ii, 263).

In the hope of obtaining a perfect voltametric solution, hydrogen peroxide, instead of sulphuric acid, was added to the copper sulphate in order to prevent the formation of cuprous salts. The results, however, were not satisfactory, probably owing to the formation of persulphates and catalytic decomposition of the hydrogen peroxide at the electrodes. W. O. W.

Reversed Electrolysis. J. W. TURRENTINE (*J. Physical Chem.*, 1908, 12, 448—467).—A number of apparently anomalous electrolytic phenomena, which are in reality due to secondary reactions, have been examined. When a current is passed through a solution of sodium sulphate between a magnesium anode and a platinum cathode, hydrogen is evolved at the anode, which becomes covered with scales of magnesium hydroxide. It is supposed that the magnesium dissolves at the anode as a univalent metal, a secondary reaction then taking place in accordance with the equation:

$$Mg_2SO_4 + 2H_2O = MgSO_4 + Mg(OH)_2 + H_2.$$

In a similar way, hydrogen is evolved at an aluminium anode in the electrolysis of a solution of sodium chloride. It is not possible to determine the effective valence with which solution takes place.

When a solution of potassium permanganate acidified with sulphuric acid is electrolysed between platinum electrodes, the gas evolved at the cathode contains a considerable proportion of oxygen. This has been traced to the decomposition of hydrogen peroxide formed by the electrolytic reduction of manganese dioxide. H. M. D.

Migration of Ions in Heterogeneous Systems. KARL SPIRO and LAWRENCE J. HENDERSON (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 91—92).—Solutions of phosphates, carbonates, and globulins of the same composition are separated by a membrane, on one side of which a substance such as calcium carbonate, magnesia, or globulin is suspended. When carbon dioxide is passed through the solution which does not contain the suspended matter, its alkalinity to methyl-orange increases; the increase is diminished by passing in oxygen. This arrangement behaves in the same way as blood, and the experiments show that the phenomena are due to simple diffusion, and the assumption of a selective permeability of the walls of the red corpuscles under the influence of carbon dioxide is unnecessary. T. E.

The Part Played by Ionisation in Certain Chemical Reactions. WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1908, 305—306).—The double decomposition between soluble chlorides and insoluble carbonates in the presence of water is due to the ionisation of the soluble salt; thus in the case of potassium chloride and barium carbonate a small part of the dissociated salt reacts with the barium carbonate to form barium chloride and potassium carbonate. M. A. W.

Estimation of the Hydration of Ions from Measurements of Electromotive Forces. Gilbert N. Lewis (*Zeitsch. Elektrochem.*, 1908, **14**, 509—510; *J. Amer. Chem. Soc.*, 1908, **30**, 1355—1357).—The *E.M.F.* of a concentration cell depends on the ratio of the "activities" of both the electrolyte and the water in the two solutions (this vol., ii, 16), and on the numbers of ions and molecules of water transported by the current. A measurement of the *E.M.F.* of a cell in which the electrolyte has the same concentration in each solution and therefore the same activity, whilst the activity of the water in one solution is altered by the addition of a non-electrolyte, should make it possible to estimate the number of molecules of water carried along with the ions of the electrolyte. T. E.

Improved Apparatus for the Measurement of Transference Numbers in Solutions of the Halogen Acids and their Salts. Edward W. Washburn (*Technology Quart.*, 1908, **21**, 164—177).—The essentially new features of the author's apparatus are represented by the special form of the silver anode and the silver halide cathode. The anode consists of a silver wire wound into a flat spiral, which is placed at the bottom of a Soxhlet extraction cartridge, this being filled with small crystals of electrolytic silver, which are packed tightly round the silver wire. This arrangement gives an electrode of very large active surface. Using a cartridge 6 cms. long and 1·9 cms. in diameter, an electrode prepared in this way will carry a current of 0·1 ampere for sixteen hours without the formation of the slightest trace of acid or of colloidal silver chloride.

The cathode consists of a silver disk prepared by making it the anode in the electrolysis of a solution of sodium chloride. The disk, which just fits into the apparatus, is covered with a layer of silver chloride, obtained by precipitating a hot solution of silver nitrate with excess of an alkali chloride solution. An electrode, 2·3 cms. in diameter, is able to carry a current of 0·5 ampere without the evolution of hydrogen or the formation of the slightest trace of alkali.

The anode and cathode tubes of the apparatus are provided with stopcocks, and are connected by means of a ground-glass joint.

H. M. D.

Hydrolysis of Salts in Solution: Lecture Experiment. Bartolo L. Vanzetti (*Gazzetta*, 1908, **38**, ii, 98—99).—The following simple experiment renders evident the phenomenon of hydrolysis of salts. A test-tube is filled to about three-fourths of its height with a 5—10% gelatin solution containing faintly alkaline phenolphthalein. When the gelatin has solidified, a 10% ferric chloride solution is poured on to it. As diffusion into the gelatin proceeds, two strata become more and more distinct, the lower one being colourless, owing to the more rapid diffusion of the acid liberated by hydrolysis, and the less advanced, opaque one consisting of ferric hydroxide. Salts, such as nickel chloride or copper sulphate, containing a coloured ion may also be used. T. H. P.

Change of Colour of Phenolphthalein. RUDOLF WEGSCHEIDER [with A. SCHUGOWITSCH] (*Zeitsch. Elektrochem.*, 1908, **14**, 510—512. Compare Abstr., 1904, ii, 512; this vol., ii, 646).—The concentration of the red ions in dilute alcoholic solutions containing known quantities of phenolphthalein and sodium hydroxide is determined by comparison of the colour with solutions containing an excess of sodium hydroxide. It is found that the expression $[RH][OH']/R'$ (where R' represents the phenolphthalein ion) is only approximately constant when there are more than two molecules of sodium hydroxide for each molecule of phenolphthalein in solution. On the assumption that the red salt contains two atoms of sodium (Abstr., 1905, i, 440), and that it is hydrolysed thus: $R'' + H_2O \rightleftarrows RH' + OH'$ and $RH' + H_2O \rightleftarrows RH_2 + OH'$, a satisfactory explanation of the results obtained is possible. T. E.

New Method for Determining the Specific Heats of Liquids. THEODORE W. RICHARDS and ALLAN WINTER ROWE (*Zeitsch. physikal. Chem.*, 1908, **64**, 187—200).—The liquids, the specific heats of which are to be compared (for example, water and a salt solution), are successively put in the calorimeter, and a definite quantity of heat is developed each time by neutralising a given quantity of acid with alkali in a platinum vessel, which is immersed in the liquid of the calorimeter. The calorimeter itself is completely surrounded by a jacket, the temperature of which is constantly adjusted to the changing temperature of the calorimeter (see Richards, Henderson, and Forbes, Abstr., 1905, ii, 677; Richards, Henderson, and Frevert, Abstr., 1907, ii, 604). The rise of temperature, therefore, in the calorimeter takes place adiabatically. The same apparatus may obviously be employed in the determination of heats of dilution.

One or two experiments made with this apparatus are recorded. The specific heat of a hydrochloric acid solution of the composition $HCl + 200H_2O$ has been found to be 0·9809, and the maximum deviation from this figure in four independent experiments was 0·03%. The heat developed when a solution of the composition $NaOH + 5{\cdot}85H_2O$ is diluted until it has the composition $NaOH + 43{\cdot}5H_2O$ is 3·79 kilojoules. J. C. P.

Specific Heats and Heats of Fusion of Isomorphous Substances and their Mixtures. A. BOGOJAWLENSKY and N. WINOGRADOFF (*Zeitsch. physikal. Chem.*, 1904, **64**, 251—254).—The authors have determined the specific heats and latent heats of fusion for mixtures of (1) *m*-chloronitrobenzene and *m*-bromonitrobenzene, (2) α-chlorocinnamaldehyde and α-bromocinnamaldehyde, (3) azobenzene and dibenzyl. They find that the specific heats of these isomorphous mixtures, in both the liquid and the solid state, can be calculated by the mixture rule. In the first two cases, the latent heat of fusion (f) can be calculated by the mixture formula $f=(f_1p_1+f_2p_2)/(p_1+p_2)$ in fair agreement with the observed values, but in the third case there are marked discrepancies, the observed values being regularly less than the calculated values. It is noted that only in this third case does the freezing-point curve exhibit a minimum, and that the discrepancies referred to are similar to those observed with substances which form a eutectic mixture.

J. C. P.

Specific Heat of Mercury. W. A. Kurbatoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 811—813).—The results of a number of measurements show that the mean specific heat of mercury from 0° to 306° is 0·0325—0·0331. This value, together with that previously obtained by the author (Abstr., 1903, ii, 130), and those of other investigators, prove that the specific heat of mercury rises distinctly as the boiling point is approached.

In general, the specific heat of substances, the molecules of which do not change from the melting point to the critical temperature, is represented by a curve approximating to a straight line, and the true specific heat is the minimum between these two temperatures.

T. H. P.

Specific Heat of Alcohol and of its Mixtures with Water. Antony G. Doroschewsky and Adam W. Rakowsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 860—886).—The authors discuss the various formulæ which have been proposed for expressing the specific heat of alcohol at different temperatures, and come to the conclusion that all these formulæ refer, not to absolute alcohol, but to alcohols containing small, and probably varying, proportions of water. For carefully dehydrated alcohol, the value 0·6597 is obtained as the mean specific heat at 22—99°; this gives the value 0·518 for the specific heat at 20°, taking the value 0·0035 given by Hirn's measurements (*Ann. Chim. Phys.*, 1867, [iv], **10**, 32) for the temperature-coefficient between 20° and 100°. For the alcohol used by the authors, D^{15}_{15} 0·79426 and k at 15° is $0\cdot097 \times 10^{-6}$ ohms.

In general, the changes of specific heat (C) of mixtures of alcohol and water with temperature are irregular. Thus, for 10—40% aqueous alcohol solutions, $C_{0-15^\circ} > C_{0-30^\circ} > C_{0-45^\circ} < C_{0-54^\circ} < C_{0-98^\circ}$, and for 10—20% solutions, $C_{0-15^\circ} > C_{0-98^\circ}$.

For solutions containing 100—50% of alcohol, the specific heat is expressed by the equation: $C = 0\cdot6628 + 0\cdot007945\ (100-p) - 0\cdot000045\ (100-p)^2$, where p represents the % of alcohol by weight in the solution. For 50—20% solutions, $C = 0\cdot9475 + 0\cdot005164\ (50-p) - 0\cdot0000625\ (50-p)^2$, and for 20—0% solutions, $C = 1\cdot0455 - 0\cdot00104\ (20\cdot09-p) - 0\cdot0000482\ (20\cdot09-p)^2$.

The authors' results show that Thomsen's supposition (*Thermochem. Untersuch.*, 1882, vol. i, 74), that at their boiling points the heat effect of the formation of aqueous-alcoholic solutions is zero, is not general, but applies only to one definite solution. The temperature at which the mixing has a zero heat effect is below the boiling point for strong solutions, and above the boiling point for dilute solutions of alcohol. T. H. P.

Equation of Condition for Metals: Correction. Max Thiesen (*Ber. deut. phys. Ges.*, 1908, **6**, 604).—According to Grüneisen (this vol., ii, 563), for those metals which have been sufficiently investigated, the relation between the specific heat and the coefficient of expansion is nearly independent of the temperature. In deriving the form of the temperature function of these two magnitudes (this vol., ii, 659), the author assumed that the θ of equation 4 (*loc. cit.*) was a pure temperature function, an assumption which is not justified. The value of θ is given only by a partial differential equation, which leaves the form of the temperature function undetermined. The relations given by the author do not, therefore, follow as consequences of Grüneisen's experimental law, but must be tested by direct experiment, as has been done in the case of platinum. T. H. P.

Melting-point and Freezing-point Curves of Binary Systems when the Solid Phase is a Mixture (Amorphous Solid Solution or Mixed Crystals) of the Two Components. Johannes J. van Laar (*Zeitsch. physikal. Chem.*, 1908, **64**, 257—297).—A mathematical discussion of the possible forms of curve. In the case of optical isomerides and tautomeric substances, a minimum or eutectic point in the freezing-point curve is impossible (compare Roozeboom, Abstr., 1899, ii, 355, 401). When a racemic compound is formed, two eutectic points are possible. The formation of liquid mixed crystals is also discussed.

In Tammann's method of representing the total heat-content of binary systems (this vol., ii, 660), the heat of mixing may only be neglected in comparison with the heat of fusion so long as only stable systems are dealt with. In the labile region below the eutectic point, the heat of mixing may be considerable. C. H. D.

Reciprocal Salt-pairs. I. Ernst Jänecke (*Zeitsch. physikal. Chem.*, 1908, **64**, 305—327. Compare Meyerhoffer, Abstr., 1901, ii, 639).—The conditions occurring in the melting and solidifying of reciprocal pairs of salts, in which there is an equilibrium $M'R' + M''R'' \rightleftharpoons M'R'' + M''R'$, when only one liquid phase is present, are discussed for the two cases: (*a*) when the only solid phases are the four salts; (*b*) when only two isomorphous mixtures separate. The equilibrium diagrams for case (*a*) are completely discussed. In case (*b*) there are many possibilities. The simplest conditions occur when the melting points of each pair of reciprocal salts have neither a maximum nor a minimum point; the whole system may then be broken up into two ternary systems.

The eutectic curve between the two solid phases may be without any maximum or minimum, or may have either a maximum or a minimum. The last of these cases is illustrated by the system $(K_2,Na_2)-(Cl_2,SO_4)$ (this vol., ii, 841). C. H. D.

Character of Melting-Point and Clearing-Point Curves for Fluid-Crystalline Substances and their Mixtures. II. ALEX. BOGOJAWLENSKY and N. WINOGRADOFF (*Zeitsch. physikal. Chem.*, 1908, 64, 229—242. Compare Abstr., 1907, ii, 844).—The method described in the earlier paper has been applied to other binary mixtures, namely, (1) *p*-azophenetole + *p*-azoanisolephenetole, (2) *p*-ethylpropylazophenol + *p*-methylpropylazophenol, (3) *p*-azoanisole + *p*-azoanisolephenetole, (4) *p*-azophenetole + *p*-dipropylazophenol, (5) *p*-azoanisolephenetole + *p*-dipropylazophenol, (6) *p*-azoanisolephenetole + azoxyanisole, (7) *p*-azoxyphenetole + *p*-azoanisolephenetole, (8) *p*-methylpropylazophenol + *p*-azoanisole, (9) *p*-methylpropylazophenol + dipropylazophenol.

The melting-point curves obtained in cases (1) and (2) show that complete series of mixed crystals are formed; the melting-point curves obtained in cases (3) and (4) exhibit a minimum, but it is not certain whether this is an eutectic or not; in cases (5), (6), and (7) the melting-point curves are all marked by eutectics; in cases (8) and (9) the melting-point curves were not traced.

The clearing-point curves show that in all cases the fluid-crystalline phases are completely miscible. The direction of these curves depends exclusively on the clearing points of the two components, and is independent of the course of the melting-point curve. Hence it comes that, as in cases (1) and (2), two substances the clearing points of which lie below their respective melting points form fluid-crystalline mixtures within certain limits of concentration. In cases where the labile clearing point of one component cannot be determined directly, owing to the impossibility of supercooling, it may be ascertained by extrapolating the clearing-point curve, which in the majority of cases is nearly a straight line.

The melting points and clearing points for various azo- and azoxy-compounds are as follows, the melting point being given first in each case: azoanisole 164·1°, 108·0°; azophenetole, 160·2°, 156·1°; *n*-dipropylazophenol, 146·1°, 112·0°; ethyl-*n*-propylazophenol, 144·2°, 139·6°; methylethylazophenol, 134·5°, 132·2°; methyl-*n*-propylazophenol, 113·1°, 110·0°; azoxyphenetole, 136·9°, 167·5°; azoxyanisole, 117·4°, 134·4°; *n*-dipropylazoxyphenol, 116·0°, 122·0°; azoxyanisolephenetole, 93·5°, 149·6°. It will be observed that all the azo-compounds are monotropic, that is, their clearing points lie below their melting points, whilst the azoxy-compounds are enantiotropic. J. C. P.

Inverse Melting Points. J. N. BRÖNSTED (*Zeitsch. physikal. Chem.*, 1908, 64, 374—377).—The course of the solubility curves for the hydrates of ceric sulphate (Koppel, Abstr., 1904, ii, 819) indicates that two of the hydrates, $Ce_2(SO_4)_3,9H_2O$ and $Ce_2(SO_4)_3,5H_2O$, are only stable at higher temperatures, passing into the octahydrate and the tetrahydrate at 35° and 100° respectively. Since this would mean the conversion of a solid hydrate into a lower hydrate and an aqueous solution on cooling, the temperatures mentioned may be regarded as inverse melting points. Such fusion on cooling was not directly observed, but is a thermodynamical consequence of the position of the solubility curves.

It is shown on theoretical grounds that inverse melting points can only occur when, as is the case with ceric sulphate, the solubility of the salt diminishes with increasing temperature. C. H. D.

A Modification of the Cryoscopic Method for Investigating Small Quantities of liquid. Tōsaku Kinoshita (*Biochem. Zeitsch.*, 1908, **12**, 390—406).—With certain modifications, the Beckmann method can be applied to small quantities of liquid. The chief of these consists in enveloping the thermometer bulb with a thin layer of paraffin, ash-free filter-paper, and sheet-rubber. S. B. S.

Analysis of the Lowering of the Freezing Point in Physiological Fluids. II. Lowering of the Freezing Point of Suspensions. Ernst Tezner and Johann Roska (*Zeitsch. physiol. Chem.*, 1908, **56**, 495—506).—The depression of the freezing point of water by the addition of a fatty acid is not nearly so marked when solid particles, such as blood-charcoal or casein, are suspended in the solution. This effect is attributed to adsorption, which produces a concentration of the solute around the solid particles, and thus diminishes the concentration of the rest of the solution.

The adsorption depends mainly on the surface tension, and this again on the concentrations of the various dissolved materials, but is not directly proportional to their osmotic concentrations. Hence the lowering of the freezing point of such solutions is not a simple function of the osmotic concentration.

Negative adsorption is not met with. The process of filtration yields a liquid with the same or greater lowering of the freezing point, according as the filtration is more or less complete. J. J. S.

Influence of the Rate of Cooling on the Composition of Saturated Mixed Crystals. W. von Lepkowski (*Zeitsch. anorg. Chem.*, 1908, **59**, 285—292).—Experiments have been made to ascertain whether molten alloys of bismuth and tin and of copper and silver give rise to mixed crystals when rapidly cooled. The supersaturation phenomena requisite for the production of these crystals are found in the case of bismuth-tin alloys, but not in the case of copper-silver alloys.

Alloys containing up to a little more than 1% of tin show no trace of the eutectic mixture when rapidly cooled, but this is found if the percentage of tin exceeds 1·5. The supersaturated mixed crystals, which are formed in the first case, are unaltered by exposure for six hours at 120°.

The difference in behaviour of bismuth compared with copper and silver is attributed to the greater velocity of crystallisation of the supercooled metal in the case of bismuth. H. M. D.

Vaporisation. II. Hanns von Jüptner (*Zeitsch. physikal. Chem.*, 1908, **63**, 579—618. Compare this vol., ii, 663).—Starting with van der Waals' equation, the author deduces formulæ for the calculation (1) of the internal pressure, $\pi = a/v^2$, due to molecular attraction; (2) of the fraction of the total volume actually occupied by the molecules. The values of these are then deduced for a large number of substances. It is found that the value of a, in general, increases with the molecular weight, although constitutive influences make themselves felt. From these values of a, the critical constants are calculated, and the expressions $(p_k + \pi_k)/p_k = A$ and $v_i/v_k = B$ [v_i = ideal volume] are evaluated. It is shown that, in general, A increases with B. The question how far these various quantities are affected by molecular association at the critical temperature is also discussed. The term b in van der Waals' equation is regarded as variable with the temperature and internal pressure, possibly also with the attraction of neighbouring molecules. J. C. P.

Determination of Vapour Pressures of Solutions with the Morley Gauge. OLIN F. TOWER (*J. Amer. Chem. Soc.*, 1908, **30**, 1219—1228).—The methods most commonly used for determining the vapour pressures of solutions are of two kinds, which may be distinguished as the "differential" and the "dynamic" methods. In the former, the difference between the two vapour pressures, such as that of a given solvent and one of its solutions, is measured by means of a suitable gauge, whilst the latter method is based on the principle that when air, or some other inactive gas, is saturated with the vapour of the liquid or solution, the following relation holds: total volume/volume of the aqueous vapour = total pressure/pressure of the aqueous vapour. Ostwald has simplified this method by allowing the air to bubble first through the solution and then through pure water.

A method has now been studied which is of the "differential" class, and resembles that of Smits, except that his micromanometer is replaced by a mercury gauge, designed by Morley (*Amer. J. Sci.*, 1902, **13**, 455) for measuring small differences of pressure. Determinations have been made of the vapour pressures of aqueous solutions of sucrose, potassium iodide, and lithium chloride, and of methyl- and ethyl-alcoholic solutions of tetraethylammonium iodide, potassium iodide, and lithium chloride. The results are tabulated.

It has been found that this method involves several difficulties and sources of error. The readings vary considerably, and it is therefore necessary to make a great many readings and take the average. The time occupied in this way, and also in repairing breaks and overcoming other difficulties, is very great. Moreover, the solutions must always be maintained at a temperature lower than that of the gauge. For these reasons, this "differential" method is regarded as less trustworthy, and subject to more limitations than the "dynamic" or air-bubble method. E. G.

Osmotic Researches. I. ERNST COHEN and J. W. COMMELIN (*Zeitsch. physikal. Chem.*, 1908, **64**, 1—52).—The authors review the attempts which have been made to measure osmotic pressure directly, and criticise in detail Kahlenberg's experimental methods and conclusions (Abstr., 1906, ii, 337). An osmotic apparatus has been devised in which the weaknesses of Kahlenberg's osmometer are remedied, and with which the osmotic pressure of sucrose in pyridine has been determined. As in Kahlenberg's experiments, the semipermeable membrane was of india-rubber. The authors show that it is immaterial whether the contents of the osmotic cell are stirred or not. It has not been found possible to get consistent values for the osmotic pressure in parallel experiments, and all the pressures recorded were far below the theoretical values. The authors consider it probable that water is responsible for the irregular results obtained, for it has been found that the presence of water either in the solution or in the pure solvent exerts a very marked influence on the observed pressure. Fresh experiments are therefore planned in which perfectly anhydrous pyridine will be employed. J. C. P.

[Vapour Pressure of Dry and of Ordinary Sal Ammoniac.] RICHARD ABEGG (*Zeitsch. physikal. Chem.*, 1908, **63**, 623—624).—A reply to van Laar (this vol., ii, 569). J. C. P.

The Avogadro-Guldberg Law. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 813—817).—It was shown by Guldberg that the absolute boiling points of different substances represent "corresponding" temperatures, as they are always two-thirds of the absolute critical temperatures. The author finds, however, that this relation is considerably influenced by various factors, and, on the basis of a large number of experimental numbers given by various investigators, he formulates the relationship between boiling point and critical temperature as follows. With all substances having less than five atoms in the molecule, and having, also, low molecular weights, the ratio of boiling point to critical temperature has the mean value 0·666. The ratio varies, however, from 0·580 for the lower members of a homologous series to 0·700 for the highest members investigated. T. H. P.

Calculation of Thermochemical Constants. V. Calculation of the Thermal Constants of Aromatic Substances. H. STANLEY REDGROVE (*Chem. News*, 1908, **98**, 80. Compare this vol., ii, 564).—The author gives in tabular form a comparison of the molecular heats of combustion and formation as determined by Thomsen, and as calculated by himself for toluene, mesitylene, ψ-cumene, chlorobenzene, anisole, and phenol. The method of calculation does not necessitate any assumption concerning the constitution of benzene. The figures show that the various groups exhibit the same thermal behaviour in aromatic as in aliphatic compounds. P. H.

Free Energy Changes Attending the Formation of Certain Carbonates and Hydroxides. JOHN JOHNSTON (*J. Amer. Chem. Soc.*, 1908, **30**, 1357—1365. Compare this vol., ii, 358).—The increase of free energy attending the conversion of a hydroxide into the oxide and water vapour, and of a carbonate into the oxide and carbon dioxide, can be expressed by the equation $\Delta F = \Delta H + RTlnp + IT$ (ΔH being the increase in total energy). Calculations from existing pressure data for the hydroxides and carbonates of magnesium, calcium, lithium, strontium, and barium give, in general, very concordant values for I, the thermodynamically undetermined constant, The increase in free energy at 25°, accompanying the formation of these substances, and their dissociation pressures at 25° have been calculated. The results show that the stability of the hydroxides and carbonates increases in the order magnesium, calcium, lithium, strontium, barium, sodium.

It is shown that neither Le Chatelier and de Forcrand's rule, $T=\Delta H/30$, nor Nernst's approximate formula for heterogeneous equilibria, $\log p=\Delta H/4{\cdot}576T+1{\cdot}75\log T+C$, can lead to accurate results, except in special cases. E. G.

Hydrolysis as Illustrated by Heats of Neutralisation. VICTOR H. VELEY (*Trans. Faraday Soc.*, 1908, **4**, 19—26. Compare Lundén, this vol., ii, 164).—The paper contains a summary of the available data as to the acid and basic dissociation constants of a number of weak bases and acids and the degree of hydrolysis of their salts, as determined by Bredig, Winkelblech, Walker, Lundén, and the author. The heats of neutralisation determined directly of these weak bases and acids are also given as far as available, as are the values calculated by Lundén and others by means of the van t'Hoff equation connecting heat development and displacement of equilibrium. The data appear to show that the higher the value for the heat of neutralisation the less is the degree of hydrolysis, and conversely.

G. S.

Orthobaric Volumes in Relation to Pressure and Temperature. EDWARD HAIGH (*Phil. Mag.*, 1908, [vi], **16**, 201—223); SYDNEY YOUNG (*ibid.*, 222—223).—Haigh puts forward a dual equation to express the relation of the orthobaric volumes of liquid and saturated vapour to vapour pressure and temperature of ebullition. At the critical point, the dual equation reduces to the well-known van der Waals' form. The dual equation affords results which are in excellent accord with the experimental values in the cases of fluorobenzene, *iso*pentane, benzene, and a number of other hydrocarbons. The small deviations observed with methyl and propyl alcohols, carbon tetrachloride, and stannic chloride are explainable as polymerisation effects and experimental errors.

With a liquid far removed from its critical point, a small experimental error in the volume is greatly magnified, and the spheres of action of the molecules may intersect. The theorem may be utilised to test the accepted values of the critical constants of a substance, for on combining them with the data of observations at temperatures below the critical point, the dual equation should hold good.

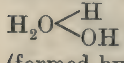
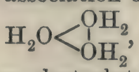
From the specific volumes of *iso*pentane liquid and vapour at temperatures between 10° and 120°, the critical volume of this substance is calculated to be 4·2686, whereas Young obtained the value 4·266 experimentally.

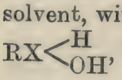
This agreement does not constitute an independent proof of the validity of the dual equation, since the value of the critical volume (4·266) was assumed for the purposes of the former proof. R. J. C.

Saturated Aqueous Solutions of Sparingly Soluble Salts. II. The Amounts Dissolved and their Alteration with Temperature. FRIEDRICH KOHLRAUSCH (*Zeitsch. physikal. Chem.*, 1908, **64**, 129—169. Compare Abstr., 1903, ii, 528).—The experimental material previously collected (*loc. cit.*) has been subjected to recalculation, with the result that some of the values for the solubility already communicated (Abstr., 1905, ii, 152) have undergone alteration. In this extension of the work, special attention has been paid to ascertaining the value of the equivalent conductivity which should be employed in calculating the solubility from the specific conductivity of the saturated solution. It is only in the case of salts with extremely low solubility that λ_∞ can safely be taken as the equivalent conductivity of the saturated solution. The correct value can, however, be ascertained on the basis of the rule that in dilute solutions λ changes almost proportionally with the square root of the concentration. For details of the way in which this rule is applied to the different salts, the original must be consulted. Another point to which attention has been paid in this extension of the work, is the evaluation of the solubility for temperatures other than 18°.

The following is a list of the salts for the solubility of which an appreciably different value has been found on recalculation; the number given after each salt represents the weight in milligrams present in a litre of the saturated solution at 18°: magnesium fluoride, 87; silver chloride, 1·34; silver iodate, 38·5; lead iodate, 17·8; barium chromate, 3·5; lead chromate, 0·1; barium oxalate ($BaC_2O_4,2H_2O$), 85·1; barium oxalate ($BaC_2O_4,3\frac{1}{2}H_2O$), 105. In addition, numbers are given for the following minerals: fluorite, 15·0; barytes, 2·6; celestine, 114·3.

For the values of the solubility at temperatures other than 18°, the original must be consulted. Of the salts examined, magnesium fluoride is the only one the solubility of which diminishes as the temperature rises.
J. C. P.

Studies of the Processes Operative in Solutions. VI. Hydrolysis, Hydrolation, and Hydronation as Determinants of the Properties of Aqueous Solutions. HENRY E. ARMSTRONG (*Proc. Roy. Soc.*, 1908, **81**, *A*, 80—95. Compare Abstr., 1907, ii, 848, 849, 850).—Water is regarded as a complex mixture of active and inactive molecules; the active components are monad *hydrone* (H_2O) molecules and *hydrol-hydrone* (briefly hydronol or hydrol) molecules,  $H_2O\!<\!\genfrac{}{}{0pt}{}{H}{OH}$; the inactive molecules are a series of polyhydrones (formed by association unaccompanied by rearrangement) of the form $H_2O{:}OH_2$,  $H_2O\!<\!\genfrac{}{}{0pt}{}{OH_2}{OH_2}$, &c.

When non-electrolytes of the type RX are dissolved in water, interaction takes place with the hydrol molecules present in the solvent, with the ultimate possible production of active complexes,  $RX\!<\!\genfrac{}{}{0pt}{}{H}{OH}$, inactive hydrone complexes, $RX{:}OH_2$, and polymerides of the type $RX{:}XR$.

When, on the other hand, substances which form conducting solutions are dissolved in water, not only does the compound become hydrolated with formation of complexes of the type $\mathrm{RX}<^{\mathrm{H}}_{\mathrm{OH}}$ (*a*), but its component groups also become distributed (rearranged), forming complexes of the type $\mathrm{H_2O}<^{\mathrm{R}}_{\mathrm{X}}$ (*b*); the latter process is a kind of hydrolysis, but the groups are only distributed and not set free. The occurrence of electrolysis in such solutions is dependent on influences which the composite molecules (*a* and *b*) exert reciprocally on one another whilst under the influence of the electric strain.

The above considerations are applied to the interpretation of the most various properties of aqueous solutions, such as electrolytic conductivity, hydrolysis, neutralisation of acids by alkalis, hydration, compressibility, and the so-called ionic properties of aqueous solutions. It is considered that the conductivity in concentrated solutions is conditioned mainly by molecules of the hydrolysed solute of type *b*, whilst in dilute solutions it is due mainly to molecules of type *a*. In general, the changes which take place in aqueous solution involve the interaction of the composite molecules above referred to; for example, the neutralisation of hydrochloric acid by sodium hydroxide may be represented by the equation:

$$\mathrm{HCl}<^{\mathrm{H}}_{\mathrm{OH}} + \mathrm{NaOH}<^{\mathrm{H}}_{\mathrm{OH}} = \mathrm{NaCl} + 3\mathrm{H_2O}.$$

The considerable expansion attending such neutralisations cannot be adequately accounted for on the ionic theory, but on the present theory, is a simple consequence of the different modes of combination of the water before and after neutralisation. It is shown that when measurements are made with weight-normal solutions, the change of volume on neutralisation is greater for sodium than for potassium salts.

Hydration may be of two kinds, according as it involves hydrolation or hydronation. The effect of sugars in reducing the conductivity of electrolytes (compare No. X) is probably connected with the association of their oxygen atoms with hydrol. In hydrones, for example, $\mathrm{NaCl{:}OH_2}$, the salt is rendered comparatively inactive, but, owing to the ethenoid linking, the associated water has probably a greater optical effect than ordinary water, the increase in refractive index which attends solution in water being thus accounted for.

G. S.

Studies of the Processes Operative in Solutions. VII. Relative Efficiencies of Acids as Deduced from their Conductivities and Hydrolytic Activities. Henry E. Armstrong and E. Wheeler (*Proc. Roy. Soc.*, 1908, **81**, *A*, 95—102).—The electrolytic and hydrolytic activities of hydrochloric, nitric, and sulphuric acids in various dilutions are contrasted, and the conclusion is drawn that the processes are altogether different in character. The hydrolytic activity was determined with sucrose in the usual way, and weight-normal solutions were employed.

When weight-molar solutions of the three acids are compared nitric acid is least, and sulphuric acid most, active as hydrolyst, and to reduce the other acids to the same activity as nitric acid, 3 mols. of water have to be added to the hydrochloric acid solution and 7 mols. to the sulphuric acid solution. In 1/10 and 1/20 molar solution, hydrochloric and nitric acids are more nearly equal in activity, but sulphuric acid is much stronger than either, its strength not being reduced so much by dilution. The diminution of hydrolytic activity on dilution from molar to 1/10 molar solution for the monobasic acids is not proportional to the dilution, but about 1·5 times as great.

For solutions of the three acids of equal conducting power, the hydrolytic activities at 25° are in the ratio $HNO_3 : HCl : H_2SO_4 = 100 : 107 : 180$ when the activity of weight-normal nitric acid $= 100$.

The molecular conductivities of the various solutions are also given in tabular form. G. S.

Studies of the Processes Operative in Solutions. VIII. The Influence of Salts on Hydrolysis and the Determination of Hydration Values. Henry E. Armstrong and D. Crothers (*Proc. Roy. Soc.*, 1908, **81**, *A*, 102—112. Compare Senter, Trans., 1907, **91**, 460 ; Proc., 1908, **24**, 89).—It has been shown in a previous paper (No. IV, *loc. cit.*) that the "average degree of hydration" of certain alkali chlorides and nitrates is considerably greater when determined from hydrolysis experiments with sucrose in the presence of the corresponding acids than when methyl acetate is used as hydrolyte, and that the nitrates give lower values than the chlorides, especially with methyl acetate. On the preliminary assumption that the results obtained with sucrose are the true hydration values, and that the smaller values observed with methyl acetate are due to combination of salt and ester, the average amount of each salt combined with the ester is calculated. This explanation of the different effect on the two hydrolytes is not, however, regarded as satisfactory.

In order to obtain further information on this point, the relative influence of nitrates and chlorides on the molecular solution volume of methyl acetate, and on the electrical conductivities of the respective acids in the presence and absence of methyl acetate, has been measured, but in no case is the difference so great as for the influence on the hydrolytic activity. For comparative purposes, the effect of sucrose, dextrose, and raffinose on the conductivity of the salts was also measured.

It is suggested that the differences are best accounted for on the basis of the considerations advanced in communication VI. The "hydration values" will vary from case to case, and the highest values will be obtained by using hydrolytes and hydrolysts which form relatively stable hydrols in solution, as these will be less affected by the introduction of salts. Methyl acetate holds hydrol but weakly, and is therefore easily rendered inactive by salts.

The effect of methyl acetate in diminishing the conductivity of electrolytes is probably mainly mechanical, but the sugars appear to exercise a direct dehydrolating influence as well as a mechanical effect. G. S.

Studies of the Processes Operative in Solution. IX. Determination of Optical Rotatory Power. Robert J. Caldwell and R. Whymper (*Proc. Roy. Soc.*, 1908, **81**, *A*, 112—117).—A modified polarimeter provided with a spectroscopic eyepiece is described and figured. A sodium lamp for obtaining a very bright flame is described, but the Bastian mercury lamp was found to possess considerable advantages as a source of illumination, the green line (546·1 $\mu\mu$) being very bright, pure, and of constant intensity. G. S.

Studies of the Processes Operative in Solutions. X. Changes Effected by the Reciprocal Interference of Sucrose and other Substances (Salts and Non-electrolytes). Robert J. Caldwell and R. Whymper (*Proc. Roy. Soc.*, 1908, **81**, *A*, 117—140). —The effect on rotatory power, the volume change, and (in the case of salts) the change of conductivity produced by adding sucrose to each of a large number of electrolytes and non-electrolytes in weight-molar solution, have been determined.

The influence of non-electrolytes on the rotatory power is slight; the greatest effect is exerted by acetaldehyde (an increase) and by chloral hydrate (a decrease). Electrolytes all diminish the rotation slightly, and the effect increases in the order nitrates, chlorides, sulphates, alkali hydroxides; it is ascribed mainly to combination between electrolyte and sugar.

The molecular conductivity of the most various salts (in molar solution) is reduced to the extent of 43—51% by the addition of 1 mol. of sucrose. The diminution is partly due to combination between sugar and salt, but mainly to the reduction of the salt to an inactive state, probably by withdrawal of hydrol (compare No. VI). On the basis of certain assumptions, an attempt has been made to ascertain the extent to which sugar enters into combination with certain salts. The order of the effect of salts on the rotatory power is in the main the same as that in which their conductivity is affected by the addition of sugar.

The admixture of sugar with salts in solution is usually attended with considerable expansion, but in the case of non-electrolytes there is very little effect. G. S.

Calculation of the Diffusion Constants of Non-electrolytes in Solution. Max von Wogau (*Ber. deut. physikal. Ges.*, 1908, **6**, 542—545).—By means of the author's formula (Abstr., 1907, ii, 606) for the diffusion constant of a non-dissociated substance in dilute solution, values are obtained for aqueous solutions in approximate agreement with the experimental values. The values for the diffusion constants of bromine and iodine in benzene and carbon disulphide do not agree so well with the observed values, and this is attributed to the relatively larger size of the solvent molecules. H. M. D.

Theory of Capillarity. E. T. Whittaker (*Proc. Roy. Soc.*, 1908, **81**, *A*, 21—25).—The surface energy, λ of a liquid is related to the surface tension, γ, by the equation: $\gamma = \lambda + T.d\gamma/dT$, where T denotes absolute temperature. By means of this equation, the surface energy for a few non-associating liquids has been calculated from the values of the surface tension at different temperatures observed by Ramsay and Shields, and it is then shown that the surface energy of a liquid in contact with its own vapour at any temperature is proportional to the product of the "internal latent heat" and the absolute temperature. The "internal latent heat" is that part of the observed latent heat which is used up in increasing the internal energy of a substance as it passes from the state of liquid to that of vapour.

G. S.

Viscosity of Colloidal Silver Solutions. H. W. Woudstra (*Zeitsch. physikal. Chem.*, 1908, **63**, 619—622. Compare this vol., ii, 160).—The viscosity of a given colloidal silver solution gradually diminishes with time. When solutions containing different amounts of silver are compared, it is found that the viscosity increases with the concentration. The viscosity of a colloidal silver solution is lowered by electrolytes, an observation which should be contrasted with the action of electrolytes on gelatin solutions (see, for instance, Levites, this vol., ii, 161). J. C. P.

The "Negative" Viscosity of Aqueous Solutions. William White Taylor and T. W. Moore (*Proc. Roy. Soc. Edin.*, 1908, **27**, 461—471. Compare Taylor and Ranken, *Trans. Roy. Soc. Edin.*, 1906, **45**, 397; Jones and Veazey, Abstr., 1907, ii, 438; Getman, *ibid.*, ii, 744).—In order to test the theory that the cations, in opposition to undissociated molecules and anions, tend to diminish the viscosity of water, and that the activity of the cations increases in general with the atomic volume, the authors have measured the viscosity of aqueous solutions of tetramethylammonium iodide, tetraethylammonium chloride and bromide, and of tetrapropylammonium chloride and iodide at 25° and 35°.

The viscosity increases with increasing volume of the cation, and in no case is there the slightest approach to "negative" viscosity. The influence of the anion on the viscosity is very small. The values for tetraethylammonium chloride and bromide are much more nearly equal than the viscosities of solutions of hydrochloric and hydrobromic acids, of the potassium salts, or of the ammonium salts. The viscosity of salt solutions cannot therefore be regarded as simply an additive property.

The density of tetrapropylammonium chloride solutions decreases with increasing concentration, the diminution being more marked at 35° than at 25°. H. M. D.

Theory of Adsorption. T. Brailsford Robertson (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 49—76).—A theoretical paper of a highly controversial character, in which the view is advocated that the phenomena of adsorption are in reality chemical equilibria, in which capillary condensation plays at most a very unimportant part.

T. E.

Adsorption Phenomena of Inorganic Salts. Hans E. Wohlers (*Zeitsch. anorg. Chem.*, 1908, **59**, 203—212).—When barium sulphate is precipitated in a strong solution of potassium permanganate, the precipitate carries down some of the permanganate, as is shown by the fact that after boiling with hydrochloric acid to remove manganese dioxide the precipitate is still rose-red. The amount of permanganate adsorbed is too small to be estimated gravimetrically. The adsorbed permanganate does not react with hydrogen peroxide or sulphurous acid, nor does adsorbed ferric chloride react with potassium ferrocyanide. On heating the precipitates, however, adsorbed substances undergo chemical changes; thus the pink barium sulphate becomes brown on heating, owing to the formation of manganese peroxide, and adsorbed red cobalt sulphate becomes blue on heating.

Strontium sulphate also adsorbs potassium permanganate, but calcium and lead sulphates and silver chloride do not do so to any appreciable extent.

The absence of chemical reactivity on the part of adsorbed substances might be accounted for on physical lines as being due to a great diminution of solubility, but the author considers it more probable that precipitate and adsorbed substance become chemically combined. G. S.

Dissociation of a Compound in a State of Equilibrium, and a Thermodynamic Relation Necessary to the Validity of the Law of Constant Proportions. Rudolf Ruer (*Zeitsch. physikal. Chem.*, 1908, **64**, 357—373).—It has been shown (Abstr., 1907, ii, 433) that a compound AB fusing to a homogeneous liquid, and capable of dissolving both A and B, must be dissociated when in a state of equilibrium. The conditions of such equilibria in the solid, liquid, and gaseous state are now discussed on the basis of the thermodynamic potential. It is shown on theoretical grounds that two solid or two liquid phases must always possess a certain degree of miscibility, although this miscibility may be very small. C. H. D.

The Unimolecular Course of the Decomposition of Ammonia by the Silent Discharge. Robert Pohl (*Zeitsch. Elektrochem.*, 1908, **14**, 439; Max Le Blanc, *ibid.*, 507).—A claim for priority against Le Blanc and Davies (this vol., ii, 653) and a reply by Le Blanc, who points out that, whereas Pohl found the decomposition to be unimolecular, he and Davies arrived at the opposite result. T. E.

Position of the Ammonia Equilibrium. Fritz Haber and Robert Le Rossignol (*Zeitsch. Elektrochem.*, 1908, **14**, 513—514) — In consequence of Jost's criticism (this vol., ii, 761), the authors have made measurements with thermocouples both inside and outside their quartz tube, which show that the difference of temperature is at most 3°. They maintain the accuracy of their results (Abstr., 1907, ii, 454; this vol., ii, 362). T. E.

Temperature of Dissociation of Ammonia and of Carbon Monoxide. Herman C. Woltereck (*Compt. rend.*, 1908, **147**, 460—461).—Pure dry ammonia was passed through a heated tube of Jena glass. The first signs of dissociation were observed at 620°; above 630° an explosible mixture of gases was produced. Decomposition occurred at a considerably lower temperature in presence of traces of organic matter or water vapour. When passed over heated iron gauze, dissociation commenced at 320°, whilst in presence of ferric oxide no decomposition took place below 420°.

Carbon monoxide dissociates at 570—580°, but in presence of traces of moisture no decomposition occurs even at higher temperatures.

W. O. W.

Theory of Colloids. Eduard Jordis (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 13—26. Compare this vol., ii, 675).—The suspension theory, the theory of electric charges, the adsorption theory, and the partition theory are criticised, in the sense that none of them is applicable to all colloids, and that they all neglect chemical changes in the colloid itself and reactions between it and substances in solution. T. E.

Modification of Wolfgang Ostwald's System of Colloids. P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 26—27).—In dispersed systems the dispersion may be molecular (as in true solutions of solids or liquids) or the molecules may be aggregated to minute crystals or drops (as in suspensions or emulsions). Between these extremes there are molecular dispersions of compounds of high molecular weight, and then "suspensoids" and "emulsoids" (colloidal solutions in which the colloid is solid or liquid). True solutions are called *dispersions*; colloidal solutions, suspensions, and emulsions are called *dispersoids*. The word colloid is avoided altogether. T. E.

System of Colloids. Wolfgang Ostwald (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 28—30).—The nature of gelatin and agar-agar solutions is discussed. The author gives reasons for supposing them to contain two liquid phases; the gelatinous precipitates of inorganic salts obtained by von Weimarn (this vol., ii, 90) are regarded as emulsions of two different solutions, which are prevented from mixing by solid membranes of the salt. A high molecular weight is not a necessary condition for the existence of a substance in the gelatinous form, which appears rather to depend on the physical conditions than on the chemical nature of the substance. T. E.

Classification of Solutions of Colouring Matters. H. Freundlich and W. Neumann (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 80—83).—The solutions of colouring matters are true solutions, semicolloidal and colloidal. They are classified by their diffusion through parchment paper and by their ultra-microscopic behaviour. The colloidal solutions belong to two classes, the suspension colloids, the freezing point and surface tension of which are practically the same as those of pure water, and the emulsion colloids, the properties of which differ from those of water.

Measurements of the surface tension of aqueous and alcoholic solutions of several colouring matters are given. They all form true solutions in alcohol, and the surface tension is slightly increased. Among the aqueous solutions, rhodamine (true solution), crystal-violet (semi-colloidal), and night-blue (colloidal) diminish the surface tension, whereas the other colouring matters leave it practically unchanged.

T. E.

Effect of Electrolytes on the Viscosity of Colloids. GOKUN (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 84—88).—The effect of ammonium nitrate on the viscosity of solutions of gelatin is studied. The viscosity of a pure gelatin solution (0·28%) increases with time, increasing by one-half in 115 hours. The addition of ammonium nitrate diminishes the rate of increase, so that when the concentration of the salt is from $1·5N$ to $2N$, the viscosity remains almost constant; with greater concentrations, the viscosity diminishes with the time instead of increasing. The viscosity depends on the mechanical treatment to which the solution has been subjected; repeated passage of the same solution through a capillary tube gives different results; also, the viscosity measured by passing the solution through a narrow tube under high pressure is not the same as that observed with a wider tube and lower pressure. This points to the existence of a structure in the solutions.

T. E.

Nature of Precipitated Colloids. HARRY W. FOOTE (*J. Amer. Chem. Soc.*, 1908, 30, 1388—1394).—Experiments are described which afford evidence that precipitated ferric and aluminium hydroxides may be regarded as solutions of water in the oxides or lower hydroxides, that is, solutions of liquids in solids.

Samples of the precipitated hydroxides were left in the air for several days at the temperature at which the experiments were to be carried out. The composition of the material was then determined by ignition, and a weighed quantity was put into a porcelain crucible, which was placed on a raised triangle in a large weighing bottle containing a little water. The bottle was carefully sealed and left for eighteen to forty-eight hours. The crucible was then quickly removed, and weighed in order to determine the change of weight. The experiments were made at 25° and 45°. The composition of the product at any point could be calculated from the known composition of the original material.

All the moist precipitates lost weight slightly over water, but, after being dried in the air to a certain point, they began to gain weight when placed over water. This was due to the fact that their vapour pressures had fallen below that of the water, showing that the water phase had just disappeared. The composition at the point at which the gain in weight first occurred was approximately that of the saturated hydrate free from mechanically-contained water. The averages of a large number of determinations gave the following as the composition of the saturated solutions of water in the oxides. Ferric hydroxide at 25°: Fe_2O_3, 47·72—47·79%; at 45°, 54·53—56·74%; aluminium hydroxide at 25°: Al_2O_3, 49·52—51·17%; at 45°, 52·57—53·82%.

Similar experiments were made with zirconium hydroxide, and the composition of the saturated solutions at 25° were found to be: ZrO_2, 32·02—32·33%. E. G.

Coagulation of Colloidal Solutions in Galvanic Cells. WILHELM BILTZ (*Zeitsch. Elektrochem.*, 1908, **14**, 567—571).—Two metals are immersed in solutions of colloidal ferric hydroxide, gold, or antimony sulphide, purified by dialysis, and the cell so formed short circuited. In all cases the colloid is coagulated, the precipitate forming partly on one of the metals and partly in the solution near it. The more noble metals alone have no action; the less noble ones have a small action. Ferric hydroxide is precipitated on or near the more noble metal of the couple; gold and antimony sulphide go to the less noble metal. The phenomenon is not due to the current alone; the *E.M.F.* of the zinc copper element, for example, is under 1 volt, and this voltage applied to platinum electrodes in a gold hydrosol produces no precipitate. On the other hand, the quantity of zinc hydroxide which is formed from the zinc electrode is comparable in weight with the quantity of gold precipitated, and it is found almost entirely in the precipitate. The action therefore appears to be mainly due to the action of bivalent ions formed from the metals in the short circuited cells. T. E.

Agglutination and Coagulation. SVANTE ARRHENIUS (*J. Amer. Chem. Soc.*, 1908, **30**, 1382—1388).—The work described was carried out with the object of obtaining evidence as to the nature of agglutination. Two views have been advanced, one, the colloidal theory, according to which the suspended particles (bacteria or blood corpuscles) collect together and subside under the influence of electrolytes or agglutinins, and the other, first proposed by Duclaux, that agglutination depends on the coagulation of some substances in the cells which causes the cells to cling together and subside.

Experiments have been carried out on the precipitation and agglutination of blood corpuscles by means of various salts. Ox-blood corpuscles were suspended in solution of sodium chloride (0·9%) or sucrose (7%), the emulsions containing 4, 1, and 0·25% of corpuscles. To 5 c.c. of such solutions, varying quantities of the salt solutions were added. The minimum quantity of each salt required for precipitation and for agglutination was noted. The results are tabulated, and show that, with certain exceptions, there is a well-marked relation between the precipitating and agglutinating powers of each salt. Salts which give a maximum precipitation at a certain concentration also give a maximum agglutination at a certain concentration, but if a maximum does not appear in the one case, it also fails in the other. It is therefore concluded that, as Duclaux has suggested, agglutination depends on a precipitation, and that this precipitation is due to a chemical reaction between the metal ions and the proteins in the corpuscles. In general, both precipitation and agglutination in sugar solutions require less quantities of the added salt than in sodium chloride solutions.

Many substances cause agglutination as well as hæmolysis of the blood corpuscles, and among these may be mentioned the nitrates of silver and lead, mercuric chloride, and the acids (compare this vol., ii, 708). The hæmolytic action does not run parallel with the agglutinating action.

The quantity of a salt required to be added for the precipitation of a blood solution is proportional to the concentration of the latter. Since the quantity of the salt required increases more slowly than the concentration, it is evident that there exists a chemical equilibrium between the two salt-like products derived from the blood solution and the ions of the precipitating salt. All the evidence obtained in this investigation is in favour of the physico-chemical theory, according to which the observed phenomena are due to ordinary chemical processes.

E. G.

Permeability of Ultra-filters. HEINRICH BECHHOLD (*Zeitsch. physikal. Chem.*, 1908, **64**, 328—343).—The author's gelatin "ultra-filters" (this vol., ii, 24), for the separation of colloids from the solvent, vary in fineness according to the concentration of the gelatin. Some of them are too fine to allow of the determination of the size of their pores by ultra-microscopic examination of the colloids retained by them. By considering the pores as capillary tubes or as slots, their dimensions can be arrived at by measuring the pressure required to force air through them when immersed in water. This method was controlled by tests with a filter-paper which retains ox-blood corpuscles (diam. 7—8μ), for which the air-pressure method gave an average value of 1·5μ, and with Chamberland porcelain filters, which retain cocci (diam. 1μ), and where the method gave as a result 0·3μ. The same method provides a test for the uniformity in size of the pores. Ultra-filters may be tested in this way, and by the rate of passage of water.

Tests with ultra-filters indicate that the smallest particles of hæmoglobin have one-sixth the diameter of collargol particles, and that the smallest particles of litmus in alkaline solution, or of soap solution, have less than one-half the diameter of hæmoglobin particles.

C. H. D.

Foam Structure [Cellular Structure] of Sulphur and its Influence on Double Refraction, Dichroism, Electrical Properties and Formation of Crystals. GEORG QUINCKE (*Ann. Physik*, 1908, [iv], **26**, 625—711).—A historical account is given of work relating to the different forms which sulphur may assume. The form of the heating and cooling curves of liquid sulphur and the variation of the surface tension with the temperature are also discussed. The microstructure and the optical properties of the solid products which are obtained by cooling liquid sulphur under different conditions, and also of the products obtained by the condensation of sulphur vapour, have been examined. The conclusions of chief interest are that there are four forms of sulphur, S_α, S_β, S_δ, and S_γ, which are stable respectively between the limits 0—96°, 96—160°, 160—300°, and 300—448°; further, that liquid sulphur has a jelly-like cellular structure, and represents a mixture of solutions containing these allotropic modifications in different proportions, the several solutions being separated by limiting surfaces in which surface-tension forces play an important part. At one and the same temperature, liquid sulphur may contain solutions in which these modifications are present in different proportions, this being determined by the previous physical treatment of the sulphur. H. M. D.

Velocity of Reaction. JOHANNES J. VAN LAAR (*Chem. Weekblad*, 1908, **5**, 698—705).—A theoretical paper, in which the theory of reaction velocity is criticised, and a new thermodynamic theory put forward. A. J. W.

Temperature-coefficient of the Velocity of Chemical Reactions. I. MAX TRAUTZ and KARL THEODOR VOLKMANN (*Zeitsch. physikal. Chem.*, 1908, **64**, 53—88).—The velocity of saponification of eight esters in aqueous solution has been determined over a wide range of temperature. The temperature-coefficient of the velocity rises to a maximum between 10° and 20° in all cases, and thereafter falls off. At 60°, the value of the temperature-coefficient is frequently as low as 1·4, so that the difference in magnitude as compared with the temperature-coefficient of a photochemical reaction is not so marked as has usually been assumed. The existence of a maximum temperature-coefficient between 10° and 20° is probably connected with an irregularity which occurs in the viscosity of water in that region. The observed variation of the temperature-coefficient with the temperature may in fact be reproduced by a formula into which the viscosity of water enters.

The authors' experiments tend to show that the mass action law is strictly applicable to the saponification of esters only when the concentration is less than $N/75$.

The paper contains an extensive list of references to earlier papers on the temperature-coefficient of reaction velocity, and this earlier work is subjected to a critical review. J. C. P.

The Dynamic Theory of a Reversible Chemical Reaction. ERNST COHEN and TH. STRENGERS (*Chem. Weekblad*, 1908, **5**, 594—595. Compare Smits and Wibaut, *Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 114).—Arguments are adduced to prove that the transformation $2CO \rightleftharpoons CO_2 + C$ is not an experimental proof of the truth of the dynamic theory of reversible reactions. A. J. W.

The Dynamic Theory of a Reversible Chemical Reaction. ANDREAS SMITS and J. P. WIBAUT (*Chem. Weekblad*, 1908, **5**, 625—626; *Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 162—164). —Polemical. A reply to Cohen and Strengers (preceding abstract). A. J. W.

Effect of Ferric Salts on the Rate of Oxidation of Ferrous Salts and on the Catalytic Action of the Latter. W. F. GREEN (*J. Physical Chem.*, 1908, **12**, 389—397).—The influence of ferric salts on the rate of oxidation of ferrous salts by chloric acid and by oxygen, and on the rate of oxidation of iodides by chloric and bromic acids in the presence of ferrous salts, has been investigated. It is found that ferric salts are without influence on the rate of oxidation of ferrous salts by chloric acid and by oxygen. The liberation of iodine from iodides by chloric and bromic acids is accelerated by both ferrous and ferric salts, the rate depending merely on the amount of iron present, and not on its state of oxidation. In solutions containing ferrous and ferric salts, the effects of the two are additive. H. M. D.

Reaction between Potassium Ferricyanide and Potassium Iodide. GERHARD JUST (*Zeitsch. physikal. Chem.*, 1908, **63**, 513—578. Compare Donnan and Le Rossignol, Trans., 1903, **83**, 703).—This reaction may be conceived as involving two stages: (1) $FeCy_6''' + \ominus = FeCy_6''''$; (2) $I' + \oplus = I$. The velocity of the latter process is practically that of an instantaneous reaction, as shown by Brunner (Abstr., 1907, ii, 223). Process (1), however, is not to be regarded as an instantaneous reaction, as shown by a study of the polarisation at an electrode immersed in a solution containing both ferro- and ferri-cyanide. When the electrode consists of platinum, it is practically unpolarisable, but this is not at all the case when the electrode consists of gold or silver. Hence process (1) is not instantaneous; it is very markedly accelerated by platinum, the acceleration being apparently connected with an oxidation and reduction of the metal. The accelerating effect of platinum on the rate of reaction between potassium ferricyanide and iodide can be demonstrated directly. From the fact that process (1) is not instantaneous, the author draws the conclusion that the difference between the $FeCy_6'''$ and $FeCy_6''''$ groups cannot be one of charge alone; they must have a different constitution.

The results of quantitative experiments made on the rate of reaction between ferricyanide and iodide confirm those recorded by Donnan and Le Rossignol (*loc. cit.*), but the interpretation of the results is different. The application of the Noyes-van't Hoff formula to the author's measurements shows that the reaction is of the first order in regard to the ferricyanide, and of the second order in regard to the iodide. Altogether, therefore, the reaction between potassium ferricyanide and iodide is one of the third order, not of the fifth, as held by Donnan and Le Rossignol.

It appears fairly certain that it is the undissociated ferricyanide which takes part in the reaction, for the velocity is very markedly increased by the addition of indifferent potassium salts. In what form the iodide takes part, whether as ion or as undissociated salt, it is not possible to determine, although it is considered most probable that the ions are actively concerned.

A complete kinetic equation has not been constructed, but attention is drawn to the following observations, which would have to be considered in working out such an equation. The reaction between ferricyanide and iodide is notably retarded by ferrocyanide, but not by iodine; it is accelerated by both cyanide and fluoride ions; it is retarded by hydroxyl ions, but accelerated by hydrogen ions. Indications were also obtained that an intermediate product plays some part in the reaction. J. C. P.

Are the Stoicheiometric Laws Intelligible without the Atomic Hypothesis? OTTO KUHN (*Chem. Zeit.*, 1908, **32**, 767—769. Compare Abstr., 1907, ii, 678; this vol., ii, 98).—A further adverse criticism of the papers by Wald (Abstr., 1907, ii, 755; this vol., ii, 367). J. V. E.

Laboratory Apparatus. W. HEBER GREEN (*Chem. News*, 1908, **98**, 49—50).—*Determination of Density.*—The maximum error liable to occur in determining the density of water by means of a pear-shaped specific gravity bottle is found to be 0·00002. To obtain this accuracy, the bottle, which can only be used for temperatures above that of the surrounding atmosphere, is filled with the solution and immersed to the neck in a thermostat constant within 0·04°; after ten to fifteen minutes, the expansion of the solution through the perforated stopper is complete; the bottle is then dried and cooled for fifteen minutes, and finally weighed, the density being calculated from the formula $d = M/W.(1 + 0·0012/d - 0·0012)$, in which W and M are the apparent weights of water and solution respectively required to fill the bottle. The formula is only approximate, and disregards variations of atmospheric pressure which are often sufficient to nullify the correction. The most serious fault of the instrument is the fact that wear on the ground surfaces of the stopper and neck diminishes the capacity of the pyknometer.

A Sensitive Form of Thermo-regulator.—The thermostat is of the ordinary type, and consists of a toluene bulb of about 20 c.c. capacity attached to a U-tube containing mercury, which is connected by a capillary tube to the by-pass, the novelty of which is that the gas inlet-tube is slightly opened out instead of being left square. As soon as the mercury reaches the funnel-shaped opening of this tube, its capillarity tends to force it down again and so admit the gas supply. The temperature was found to remain constant within 0·01° for several weeks, provided the bath was efficiently stirred.

A Sensitive Temperature-compensated Barometer.—A modification of a Huyghens glycerol-mercury barometer in which the former liquid is replaced by paraffin oil, b. p. 230°. The vapour pressure of this oil varies with temperature at such a rate as almost exactly to neutralise the effects of the accompanying expansion of mercury for the particular dimensions of tubes used. The rise and fall of the liquid for a variation of one-hundredth of an inch in the atmospheric pressure is sufficiently large to be seen at some distance. P. H.

Erper's Gas Generating Apparatus. L. GUTMANN (*Zeitsch. angew. Chem.*, 1908, **21**, 1798).—The apparatus consists of a pear-shaped funnel for holding marble or iron sulphide, which is fitted into the neck of a bottle containing acid; the lower end of the bottle is connected by a side-tube and a tap, *A*, to a raised reservoir. The top of the funnel is fitted with a tap, *B*, and a delivery tube; near the lower end of the funnel is a side-tube through which the spent acid may be withdrawn after closing the delivery tube and opening the tap *B*. When re-charging with solid, the tap *A* is closed. P. H.

Modified Form of Saint-Claire Deville's Apparatus for Continuous Production of Gases. Victor Grignard (*Bull. Soc. chim.*, 1908, [iv], **3**, 890—892).—The modification is devised to overcome the disadvantages of the ordinary Saint-Claire Deville apparatus, namely, the difficulty of using up the whole of the acid and the clogging of the rubber tubing by crystals deposited from the saturated solutions formed when the apparatus has been long in action.

For this purpose, the ordinary rubber tube connexion is prolonged upwards at an obtuse angle inside the bottle containing the acid, by a glass tube reaching to a level slightly below that of the liquid, so that it is always the strongest acid which comes into action first, and the denser liquid remains at the bottom of the bottle. Continuity of action can be secured by having the side aperture of the acid bottle halfway up the latter, and making the connexion between the two bottles by two glass tubes parallel to each other and prolonged into the acid bottle at obtuse angles to the horizontal with their arms turned in opposite directions. To permit of this arrangement, the bottle containing the solid is raised on a small block, so that its side aperture is opposite that of the acid bottle. In this way by the action of gravity a continuous flow of acid through the solid to be acted on is maintained. T. A. H.

Simple Regulator for High Pressure Gas. Robert le Rossignol (*Chem. Zeit.*, 1908, **32**, 820).—By making the cone angle of an ordinary screw-down tap very small (4°), it is possible to obtain gas from a cylinder at any required pressure in a simple manner. A slow, steady current of oxygen, as used for combustion purposes, may be obtained directly from a cylinder of the compressed gas by using such a form of tap. J. V. E.

New Method for Calibrating Capillary Tubes. Bohdan von Szyszkowski (*Zeitsch. physikal. Chem.*, 1904, **64**, 201—214).—The process and apparatus are practically the same as those employed in the measurement of surface tension. The heights to which water and dilute solutions of *iso*butyric acid rise in two capillary tubes of about the same bore are accurately measured, and the exact radius of the tubes at various points is thus determined. The application of the method is illustrated by full data for two tubes which the author has examined. J. C. P.

Improved Pipette. Woithe (*Chem. Zentr.*, 1908, ii, 1; from *Arbb. Kais. Gesundh-Amt.*, 1908, **28**, 401—404).—This suction arrangement for use with very poisonous or infectious materials consists of a small syringe of about 5 to 7 ccm. capacity, connected to a pipette by a U-tube, and held by a spring-clip. J. V. E.

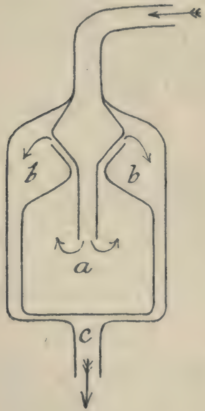
Automatic Syphon Pipette. Herbert S. Bailey (*J. Amer. Chem. Soc.*, 1908, **30**, 1508—1509).—A description and diagram are given of an apparatus for delivering approximately constant quantities of a reagent, such as the sulphuric acid for the Babcock milk test or the Kjeldahl nitrogen estimation. For details, the original must be consulted.

E. G.

Steam Inlet-tube. H. Stoltzenberg (*Chem. Zeit.*, 1908, 32, 770).—Instead of the ordinary open inlet-tube used for steam distillation purposes, a tube is described which is closed at the lower end, the steam being allowed to enter the liquid from a number of short, horizontally-curved side-tubes placed near the end. By this means the distillation flask may be used in an upright position; bumping is avoided because the liquid is caused to rotate rapidly by the issuing steam, and the process of distillation is considerably hastened.

J. V. E.

New Safety Valve. H. Stoltzenberg (*Chem. Zeit.*, 1908, 32, 832).—A safety valve is described for use when gases are to be absorbed in liquids, such as carbon dioxide in potash solution. It will be seen from the figure, that the gas after entering *a*, passes between the open ground-glass joint into the the outer vessel *b*, and then through *c* to the potash solution. Should the absorption be so rapid as to cause the potash solution to flow back, the small inner flask is lifted up and closes the joint connecting *a* with *b*.



J. V. E.

Use of Electrical Heating in Fractional Distillation. Theodore W. Richards and J. Howard Mathews (*J Amer. Chem. Soc.*, 1908, 30, 1282—1284; *Zeitsch. physikal. Chem.*, 1908, 64, 120—123).—In determining the latent heat of vaporisation of certain substances by a modification of Kahlenberg's method, it was observed that each organic liquid boiled much more constantly when heated electrically by the platinum coil immersed in it than when distilled in the ordinary way. A special form of apparatus has therefore been devised for use in fractionating organic liquids.

At the bottom of an ordinary stout distilling flask, a depression is blown of about the same diameter as the neck of the flask, and into this is placed a coil consisting of about 40 cm. of platinum wire with a resistance of about 0·7 ohm. A current of 10—15 amperes is led to the resistance coil from above by heavy copper wires of 2·5—3·0 mm. diameter enclosed in glass tubes, into the ends of which the ends of the platinum wire are sealed, contact being made by a drop of mercury.

Since the bubbles of vapour arise only from the small area of the resistance coil, ebullition proceeds quietly and without any bumping. The method is especially applicable to fractional distillation under reduced pressure; it obviates superheating, and effects a much more rapid and complete separation than the ordinary method of distillation.

E. G.

Receiver for Vacuum Fractional Distillation. J. FREUNDLICH (*Chem. Zeit.*, 1908, 32, 820).—An arrangement is described for collecting fractions in a vacuum without interrupting the process of distillation, the end of the condenser tube communicating by means of taps and short side-arms with two glass cylinders, the upper ends of which communicate with the exhaust tube by means of taps. J. V. E.

Apparatus for the Rapid Distillation of Mercury. FORTUNATO FLORIO (*Nuovo Cim.*, 1908, [v], **16**, 93—96).—An apparatus is figured and described, by which 2·5 kilos. of mercury can be distilled per hour. G. B.

Inorganic Chemistry.

A New Method for the Preparation of Pure Hydrogen. MAURICHEAU-BEAUPRÉ (*Compt. rend.*, 1908, **147**, 310—311).—Aluminium filings are mixed with a small quantity of mercuric chloride and potassium cyanide in powder. The product, to which the name "hydrogenite" is given, has D = 1·42. It can be preserved indefinitely if kept in a dry atmosphere, but when treated with water it becomes oxidised, with development of heat and liberation of pure hydrogen. One kilogram of the powder yields 1300 litres of hydrogen at 15° and 760 mm. To obtain the best yield, the action of the water must be regulated so as to maintain the temperature at about 70°, and a large excess of water should be avoided. W. O. W.

Preparation of Hydrogen Peroxide. C. A. F. KAHLBAUM (D.R.-P. 197023).—Hydrogen peroxide can be prepared from its elements, or from a mixture of steam and these elements, or even from steam alone, when these gases are passed through a source of heat with a velocity of not less than one metre per second. The source of heat may be an electric arc, a spark discharge, or a flame of burning hydrogen, and the gases may be kept stationary while the heating apparatus is rotated. On condensing the steam, the hydrogen peroxide is obtained in the form of an aqueous solution. G. T. M.

Production of Hydrogen Peroxide from Aluminium and Zinc. HOWARD T. BARNES and G. W. SHEARER (*J. Physical Chem.*, 1908, **12**, 468).—The statement made previously (this vol., ii, 344), that zinc in contact with water containing air or oxygen does not produce hydrogen peroxide, is contradicted by later observations. The difference between the behaviour of zinc and aluminium is traced to the fact that hydrogen peroxide is decomposed fairly rapidly in contact with zinc, but only slowly, if at all, in contact with aluminium. This is probably due to the difference in the extent to which the covering surface films protect the hydrogen peroxide from the action of the metals.

Copper, platinum, and iron in similar circumstances do not yield hydrogen peroxide. H. M. D.

Preparation of Perhydroxide Bases and their Salts. RICHARD WOLFFENSTEIN (D.R.-P. 196369).—*Sodium perhydroxide*, NaOOH, is precipitated by adding 30% hydrogen peroxide to alcoholic sodium hydroxide or ethoxide; it is a strongly basic substance, and, when saturated with carbon dioxide, forms sodium hydrogen percarbonate, $NaHCO_4$. This compound is more stable than the product obtained by Tafel from sodium peroxide and alcohol (Abstr., 1894, ii, 448). G. T. M.

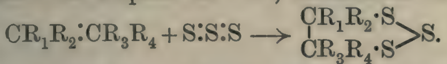
Sulphur Anion and Complex Sulphur Anions. JOSEPH KNOX (*Trans. Faraday Soc.*, 1908, 4, 29—49).—Many of the result given in the present paper have already been published (Abstr., 1906, ii, 608). The predominant complex in the solution of mercuric sulphide in sodium sulphide is Na_2HgS_2, but, when a solution saturated with both sulphides is concentrated over sulphuric acid, a double sulphide of mercury and sodium, $2Na_2S,5HgS,3H_2O$, separates in yellow crystals.

The solubility of mercuric sulphide (black and red) in potassium sulphide solutions is somewhat greater than in sodium sulphide; the solubility in equivalent dilute solutions of barium and sodium sulphide is practically equal. The solubility of mercuric sulphide in sodium disulphide, Na_2S_2, is about half that in the normal sulphide, and in this case, also, the solubility is increased by the addition of sodium hydroxide. From the results of *E.M.F.* measurements, it is probable that the complex anion present in greatest amount is HgS_2'' in this case also.

The solubility product $S = [Hg^{\cdot\cdot}][S'']$ only remains constant for different ionic concentrations when it is assumed that the hydrolysis of sodium sulphide in dilute (0·05 molar) solution is practically complete. Küster and Heberlein (Abstr., 1905, ii, 156), however, found for the same solution a value less than 90% by a method depending on the decomposition of diacetonylacetone. The author has repeated these measurements, and finds a greater degree of hydrolysis than Küster, a result which is confirmed by conductivity measurements.

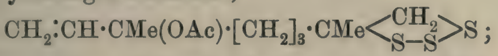
The solubility products of certain sulphides have been determined by *E.M.F.* measurements with rods of the respective metals dipping in a solution of sodium sulphide. The results at 25° are as follows: $[Ag^{\cdot}]^2[S''] = 3{\cdot}9 \times 10^{-50}$; $[Pb^{\cdot\cdot}][S''] = 2{\cdot}6 \times 10^{-15}$, and $[Cu^{\cdot\cdot}][S''] = 1{\cdot}2 \times 10^{-42}$. G. S.

Thiozonides. Sulphur and its Cyclic Compounds. HUGO ERDMANN (*Annalen*, 1908, 362, 133—173).—Hoffmann and Rothe have shown (Abstr., 1906, ii, 279) that molten sulphur cooled to 160° separates into two distinct liquid layers. The new modification of sulphur, which according to Smith and Holmes (Abstr., 1902, ii, 650) must be represented by S_x, is shown to be S_3; in fact, this highly reactive, labile, dark-coloured form of sulphur is the analogue of ozone, and is consequently named *thiozone.* As it would be more difficult to isolate thiozone in a pure state than ozone, it is best identified by its action on organic compounds. Ozone acts on unsaturated compounds, yielding ozonides or polyozonides (compare Harries, Abstr., 1906, i, 225); similarly, when unsaturated compounds are heated with sulphur at 160°, thiozonides or polythiozonides are formed:



$$CR_1R_2{:}CR_3R_4 + S{:}S{:}S \longrightarrow \begin{matrix}CR_1R_2\cdot S\\ | \\ CR_3R_4\cdot S\end{matrix}{>}S.$$

Terpene Derivatives.—Linalyl acetate is practically unattacked by sulphur at 150°, but at 160° the two substances interact energetically, yielding a *thiozonide,*

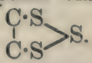


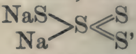
$$CH_2{:}CH\cdot CMe(OAc)\cdot[CH_2]_3\cdot CMe{<}\begin{matrix}CH_2\\ S-S\end{matrix}{>}S\,;$$

the same compound is formed whether the quantity of sulphur employed is very small or greatly in excess of that required to form the monothiozonide; the acetyl group appears to protect the second ethylene linking from the action of thiozone. The thiozonide forms a dark brown, viscid syrup, D^{23} 1·133, and has a characteristic odour. It absorbs oxygen very rapidly, and reacts both as a thio-acid and thio-base; although insoluble in alcohol, it readily dissolves in an alcoholic solution of sodium sulphide, forming a dark brown solution which contains the *sodium* salt, $C_{12}O_{20}O_2S_4Na_2$; this could not, however, be isolated. The thiozonide yields characteristic precipitates with the chlorides of antimony, arsenic, bismuth, and mercury. An ethereal solution of the thiozonide and auric chloride liberates hydrogen chloride on evaporation, leaving a brown, tarry residue of a *gold* compound, which, when heated on porcelain, leaves behind a brilliant, coherent coating of gold. The gold compound is also formed by the interaction of the thiozonide dissolved in ethyl acetate with gold sulphide.

Linalool dithiozonide is prepared by heating linalool with sulphur at 160°; hydrogen sulphide is evolved during the reaction, and the brown, viscid mass obtained has the approximate composition $C_{10}H_{16}OS_5$.

With the object of ascertaining whether linalool and linalyl acetate behave in a similar manner towards ozone, equimolecular solutions of the two substances in carbon tetrachloride were added to equal volumes of a solution of ozone in carbonyl chloride at −70° until the blue colour of the ozone had disappeared. It was found that the same quantity of ozone required twice as much linalyl acetate as linalool, so that the former evidently forms a mono-, whilst the latter forms a di-ozonide.

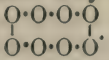
Sulphur Dyes as Derivatives of Thiozone.—This part of the paper is of a somewhat technical nature. Evidence is advanced which shows that the various sulphur dyes first formed by heating many organic compounds with sulphur and sodium sulphide are thiozonides; for example, like thiozonides, they are insoluble in most solvents, soluble in alkali sulphides, and are readily oxidised by the oxygen of the air at the ordinary temperature. The fact that most sulphur dyes are oxidised by atmospheric oxygen with the liberation of sulphuric acid, and yield hydrogen sulphide when reduced, is readily explained on the assumption that they are thiozonides containing the chromophoric group  $\begin{matrix}C\cdot S\\|\\C\cdot S\end{matrix}\!>\!S$. Ris's conclusion (Abstr., 1900, i, 419), that the sulphur liberated as hydrogen sulphide is attached to nitrogen, is very improbable.

Theory of Inorganic Polysulphides.—Although sulphur does not readily act on organic substances below 160°, yet, in the presence of sodium sulphide, action takes place at a much lower temperature. It is therefore probable that the polysulphides are closely related to thiozone. The results of work not yet published show that the alkali metals behave towards sulphur like rubidium towards oxygen (compare Erdmann and Köthner, Abstr., 1897, ii, 96); in fact, the yellow disulphide, NaS_2, corresponds with the brown oxide, RbO_2. This disulphide may be represented as a thiozonate,  $\begin{matrix}NaS\\Na\end{matrix}\!>\!S\!<\!\begin{matrix}S\\S\end{matrix}$, that is, as an additive product of the monosulphide with thiozone. Such thiozonates are among the best characterised polysulphides of the alkali metals; thus, Böttger has shown (Abstr., 1884, 1260) that alkali thiozonates containing varying, yet definite, amounts of water crystallise from solutions of polysulphides containing more or less sulphur; further, the various polysulphides, Na_4S_9, Na_2S_5, Na_3S_6 (compare Bloxam, Trans., 1900, **77**, 753), when heated at 800°, yield the thiozonate, Na_2S_4. The fact that pure sulphur dyes are formed by acting on amino-phenols with an alcoholic solution of sodium thiozonate, may be explained by assuming that the thiozonate partly dissociates when its alcoholic solution is warmed, yielding thiozone, $Na_2S_4 \longrightarrow Na_2S + S_3$, which, in the nascent state, readily unites with the amino-phenol.

Constitution of Ultramarine.—Hoffmann's conclusion (Abstr., 1879, 108), that the sulphur in ultramarine-blue is present in a similar state of combination as in the polysulphide, Na_2S_4 (sodium thiozonate), cannot be correct, since it does not yield silver sulphide with silver nitrate, but is converted into silver ultramarine, in which sodium is replaced by its equivalent of silver (compare Heumann, Abstr., 1880, 217, 367; 1881, 351). Instead, the ultramarines are to be regarded as thiozonides. Hoffmann has shown that white ultramarine, $Na_{12}Al_6S_3Si_6O_{24}$, is converted on oxidation into green, and then into blue, ultramarine, both of which also contain the three atoms of sulphur in the molecule. In strict analogy with the ultramarines, sulphur dyes are reduced by powerful reducing agents to leuco-compounds, corresponding with the white ultramarine, which are readily oxidised back to the original dye.

Chemistry of Molten Sulphur.—As has been shown, molten sulphur at 160° contains thiozone; now this substance, like sulphur dioxide, has the character of an acid anhydride, and is consequently able to bring about polymerisation of eight-membered rings (compare Harries, this vol., i, 254). Now ordinary sulphur contains eight atoms in the molecule; consequently, sulphur at 160° probably consists of thiozone, which imparts to the mass its dark colour, together with amorphous sulphur, $(S_8)_x$, which renders the mass viscid.

Constitution of Polymeric Forms of Oxygen.—Since sulphur exists as S_8, it is not improbable that oxygen might also exist in the polymerised form, O_8. Ladenburg and Lehmann (Abstr., 1906, ii, 509) appear to have obtained evidence of the existence of a highly polymerised form of oxygen, but Warburg and Leithäuser (Abstr., 1907, ii, 342) have thrown doubt on their results. However, it is not improbable that the octa-sulphates described by Weber (Abstr., 1885, 121) contain the eight-membered ring:



$$\begin{array}{c}O\cdot O\cdot O\cdot O\\ |\qquad\quad |\\ O\cdot O\cdot O\cdot O\end{array}.$$

Theory of Vulcanised Caoutchouc.—In the vulcanisation of caoutchouc, it is probable that the sulphur liberates thiozone, which forms a thiozonide, and that the viscid, amorphous form of sulphur, $(S_8)_x$, produced simultaneously, forms a semi-solid solution with the caoutchouc, which has a similar constitution to the viscid, amorphous form of sulphur, being a polymerised form of a dimethyl*cyclo*octadiene (compare Harries, *loc. cit.*). Vulcanised caoutchouc is thus a semi-solid solution of polymerised sulphur, $(S_8)_x$, in polymerised dimethyl*cyclo*octadiene, $(C_8H_{10}Me_2)_x$, and its thiozonide. Ebonite is probably a polythiozonide of caoutchouc. W. H. G.

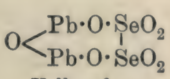
Selenium and Iodine. GIOVANNI PELLINI and S. PEDRINA (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 78—81).—From a study of the melting-point curve for mixtures of selenium and iodine, the authors conclude that these elements form no compound and no mixed crystals, except within very narrow limits. The eutectic mixture melts at 58°, and corresponds almost exactly with the supposed compound, Se_2I_2. The identical products obtained in various ways by Schneider (*Pogg. Annalen*, 1866, **129**, 627) must be regarded as mixtures of definite composition. T. H. P.

Electrolytic Formation of Selenic Acid from Lead Selenate. FRANK CURRY MATHERS (*J. Amer. Chem. Soc.*, 1908, **30**, 1374—1378).—A study has been made of the best conditions for converting lead selenate into lead and selenic acid by electrolysis. The lead selenate is placed in a platinum dish, which serves as the cathode, and a coil of platinum wire is used as the anode. Some reduction products of selenic acid are formed during the process, but these are insoluble and can be removed by filtration. The best efficiency yield, 87%, was obtained at the ordinary temperature, with a low current density at the cathode and a thin layer of lead selenate. The best current yield, 13%, was obtained at 85°, with a low current density and a large amount of lead selenate on the cathode. Selenic acid is only produced in small quantities from lead selenate in contact with the anode.

E. G.

Structural Isomerism. Preparation of Asymmetric Selenites. LUIGI MARINO (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 858—866; *Zeitsch. anorg. Chem.*, 1908, **59**, 450—460).—If the author's views concerning sulphurous acid (this vol., ii, 106) hold also for selenious acid, it should be possible to obtain asymmetric selenites. To investigate this question, the action of selenious acid on lead peroxide has been studied. In this way, besides ordinary lead selenite, a *salt*, $Pb_2Se_2O_7$, has been obtained as a sulphur-yellow, crystalline powder. When treated with potassium carbonate solution, this salt yields 1 mol. of lead peroxide and 1 mol. of lead oxide per mol., whilst the addition of dilute nitric acid to a solution of the salt in 15% sodium hydroxide solution precipitates the sesquioxide, thus: $Pb_2Se_2O_7 = Pb_2O_3 + 2SeO_2$. When heated at 200°, the yellow salt gradually changes into a white *isomeride*, exhibiting different reactions from the yellow form; for example, it does not yield lead peroxide when boiled with alkali carbonate solutions. When heated at 40—50° with dilute sulphuric acid and potassium permanganate, the white isomeride absorbs 1 atom of oxygen per mol.; under the same conditions, the yellow form is stable, but after long heating to 80° it absorbs 2 atoms of oxygen per molecule.

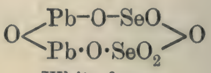
On the basis of these results, the author proposes the constitutions:



$$O\!<\!\begin{matrix} Pb\cdot O\cdot SeO_2 \\ | \\ Pb\cdot O\cdot SeO_2 \end{matrix}$$

Yellow form.

and



$$O\!<\!\begin{matrix} Pb-O-SeO \\ Pb\cdot O\cdot SeO_2 \end{matrix}\!>\!O$$

White form.

The author regards these results as lending further support to the structural formula $Pb\!\lessgtr\!\overset{O}{\underset{O}{|}}$ for lead peroxide. T. H. P.

Solutions of Metals in Non-metallic Solvents. III. Apparent Molecular Weight of Sodium Dissolved in Liquid Ammonia.

Charles A. Kraus (*J. Amer. Chem. Soc.*, 1908, 30, 1197—1219. Compare Abstr., 1907, ii, 935; this vol., ii, 486).—A study of the molecular weight of sodium and potassium in liquid ammonia was made by Joannis (Abstr., 1893, ii, 115; 1906, ii, 161) by determining the change in the vapour pressure of the solvent on addition of a known quantity of the metal. Franklin and Kraus (Abstr., 1899, ii, 202) determined the molecular weight of sodium and lithium in ammonia by the boiling-point method, and obtained results for sodium which were lower than those of Joannis. The results of Franklin and Kraus are regarded as the more trustworthy, as the solutions employed were less concentrated. The present investigation was undertaken with the object of determining the molecular weight of sodium in still more dilute solutions.

A method has been devised for measuring the changes of the vapour pressure of liquid ammonia on the addition of sodium, which gives results of an accuracy within about 1% when the total pressure change is as small as 10 mm. The apparatus employed is described with the aid of a diagram. The determinations were made at about 15°, and the concentration varied from one to ten litres per gram-atom of sodium.

The results show that in dilute solutions the molecular weight of sodium is as low as 23, and in solutions of lower concentration than $0{\cdot}1N$ is probably even lower. In the more concentrated solutions, the pressure change is smaller than would be expected from Raoult's law. The form of the complete vapour-pressure curve indicates that this deviation is due to a tendency of the solutions to separate into two phases, for which the critical point lies near 3 mols. % of sodium.

It has been shown previously (Abstr., 1907, ii, 936) that separation takes place in this region at lower temperatures. Raoult's law cannot therefore be applied to solutions of greater concentration than 0·1*N*. E. G.

Solutions of Metals in Non-metallic Solvents. IV. Material Effects accompanying the Passage of an Electric Current through Solutions of Metals in Liquid Ammonia. Migration Experiments. Charles A. Kraus (*J. Amer. Chem. Soc.*, 1908, **30**, 1323—1344. Compare Abstr., 1907, ii, 935; this vol., ii, 486, and preceding abstract).—In the first paper of this series, it was suggested that the electrical conductivity of metals is due to ionisation. In this connexion, a study has now been made of the question as to whether the transport of matter accompanies the current through solutions of metals in liquid ammonia, and quantitative migration experiments have been carried out with solutions of sodium. Such solutions are well adapted for the purpose, since they possess a characteristic blue colour, which renders concentration changes visible in solutions as dilute as *N*/40,000. It has been found that the liquid at the surface of the anode becomes colourless, whilst at the cathode the colour becomes more intense. Experiments have also been made with solutions of potassium in potassamide dissolved in liquid ammonia. In this case, it has been found that the blue colour travels towards the anode, whence it might be concluded that the metal in the solution travels in this direction. It has already been shown, however, that the metal travels in the direction of the positive current, and the direction of movement of the colour is not therefore due to a movement of the metal in this direction, but is due to interaction between the negative metal anions and potassamide, whereby free metal is reversibly produced.

From the results of these experiments, it is concluded that the process of conduction in solutions of metals is ionic. The metal constitutes the positive ion, and is identical with the positive ion of a salt of the metal dissolved in ammonia. The negative ion consists of an electron surrounded by molecules of the solvent, and is in equilibrium with ammonia according to the equation: $\epsilon^-.(NH_3)_n = \epsilon^- + nNH_3$. This electron is also in equilibrium with the metal cation and the neutral metal atoms, thus: $M^+ + \epsilon^- = M\epsilon$, where M^+ is the cation and $M\epsilon$ the neutral atom. E. G.

Oxidation of the Ammonia in Ammonium Persulphate. Mario G. Levi and E. Migliorini (*Gazzetta*, 1908, **38**, ii, 10—20. Compare Abstr., 1907, ii, 81).—Experiments made by heating solutions of ammonium persulphate at 100°, 75°, and 50° show that the ammonia of ammonium persulphate may undergo marked oxidation even in solutions which are originally neutral or almost so, and become more and more acid owing to the sulphuric acid liberated; this oxidation is rendered evident by the evolution of nitric oxide. The addition of sodium hydroxide in increasing proportions to the persulphate solution causes the oxidation first to diminish to a minimum and then to increase indefinitely.

When no alkali is present, there seems to be a true oxidation of the ammonium ions, resulting in the formation of nitric acid in the solution. Corresponding with this oxidation, the amount of oxygen evolved is less than the theoretical quantity. When the decomposition takes place in presence of alkali, the reactions become more complicated; there may then be oxidation in the liquid phase and also in the gaseous phase, especially at the surface of the separation of liquid and gas, where the ammonia may be oxidised directly by part of the oxygen evolved. The courses of these two reactions would depend on the concentrations of the ammonia in the two phases; in general, oxidation takes place more readily and more rapidly in the liquid phase.

The oxidation is diminished in absolute amount by lowering the temperature, and is augmented by increasing the concentration of the persulphate. T. H. P.

Combination of Nitrogen with Calcium Carbide. GINO POLLACCI (*Zeitsch. Elektrochem.*, 1908, 14, 565—566).—Potassium carbonate accelerates the combination of nitrogen and calcium carbide; the rate of combination is greatest when the mixture contains 4% of potassium carbonate. Increase of pressure also accelerates the reaction, but the acceleration practically reaches a limit at 2 atmospheres, further increase of pressure having little effect. Under the most favourable conditions, the conversion is complete in one hour at 900°.

T. E.

Preparation of Nitrides from Metallic Oxides or Salts with the Aid of Atmospheric Nitrogen. WILHELM BORCHERS and ERICH BECK (D.R.-P. 196323).—A metal capable of combining with nitrogen is used in the form of a fusible salt, or of its oxide mixed with a fusible fluoride. The anode compartment resembles a gas-holder dipping into a layer of some fusible metal capable of forming a fusible alloy with the metal of the salt or oxide. The fused metallic salt or mixture of oxide and fluoride is placed within the inverted anode compartment and above the layer of fused metal. The anodes are composed of some refractory material, whilst the layer of fused metal forms the cathode. On electrolysis, the metal capable of combining with nitrogen is set free at the fusible cathode and alloys with it, and thus passes from under the anode compartment.

Arrived at the outer parts of the cathode vessel, the alloy meets a current of nitrogen, with which the liberated metal combines, forming a nitride which can be removed when necessary.

In preparing magnesium nitride, the cathode vessel contains fused zinc, and the anode liquid consists of a mixture of magnesia and an alkali fluoride.

On passing the current, the liberated magnesium alloys with the zinc, and subsequently combines with the nitrogen blown into the fused metal. G. T. M.

Preparation of Alloys of Metals which Form Nitrides. Erich Beck (*Metallurgie*, 1908, **5**, 504—521).—The conditions have been studied for the electrolytic preparation of alloys, especially of magnesium, capable of yielding ammonia on treatment with nitrogen and subsequent decomposition of the nitride by steam. Tin or lead may be used as the cathode metal. When the eutectic mixture of sodium and potassium fluorides (m. p. 702°) is used as the flux, magnesium oxide is readily dissolved, an addition of 10% lowering the m. p. to 677°, but, on electrolysis, only alkali metals are set free. A mixture of calcium and magnesium fluorides also dissolves magnesium oxide, and gives good results when the cathode metal is agitated. The eutectic point of calcium and magnesium fluoride lies at 945° and 48% CaF_2; mixed crystals are not formed. Barium and strontium fluorides, on the other hand, form only mixed crystals. Mixtures of barium fluoride with the calcium-magnesium fluoride eutectic give a curve having a marked eutectic point at 790°. By the addition of magnesium oxide to this mixture, the melting point is first depressed slightly, further additions raising it considerably. This mixture gives the best results, the magnesium oxide being added gradually, but owing to its high density, a part of the magnesium rises to the surface and is burnt.

If chlorides are used instead of the fluoride-oxide mixture, carnallite gives the best results. C. H. D.

Acid Phosphates. Nicola Parravano and Aldo Mieli (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 33—41).—The authors have prepared the three acid phosphates: NaH_2PO_4,H_3PO_4; KH_2PO_4,H_3PO_4 (compare Staudenmaier, Abstr., 1894, ii, 137), and $(NH_4)H_2PO_4,H_3PO_4$, of which they have determined the solubility in phosphoric acid and the behaviour towards water. The phosphoric acid used, m. p. 40·6°, was specially purified and freed from pyrophosphoric acid.

The sodium salt, NaH_2PO_4,H_3PO_4, forms rosettes of long needles or small prisms, m. p. 126—127°. The freezing-point curve of its aqueous solution has three branches, corresponding with the separation of ice, NaH_2PO_4, and NaH_2PO_4,H_3PO_4 respectively.

The potassium salt, KH_2PO_4,H_3PO_4, for which Staudenmaier (*loc. cit.*) gave m. p. 127°, melts only partly at 127·5°, forming a liquid solution of KH_2PO_4 in H_3PO_4, whilst part of the KH_2PO_4 remains in the solid state: $x[KH_2PO_4,H_3PO_4] \longrightarrow [xH_3PO_4 + yKH_2PO_4]+[x-y]KH_2PO_4$; at 139°, the whole of the KH_2PO_4 dissolves. The freezing-point curve of its aqueous solutions has two branches, corresponding with the separation of ice and KH_2PO_4 respectively.

The *ammonium* salt, $(NH_4)H_2PO_4,H_3PO_4$, forms shining, deliquescent needles, and, on heating, behaves like the potassium salt; at 77—78°, it undergoes partial fusion, forming a solution of $(NH_4)H_2PO_4$ in H_3PO_4, together with solid $(NH_4)H_2PO_4$, whilst at 118° perfect solution occurs. Its curve of solubility in phosphoric acid has two branches meeting at 78°, which is the transformation point of the salt; one branch corresponds with the separation of $(NH_4)H_2PO_4,H_3PO_4$, and the other with that of $(NH_4)H_2PO_4$. In contact with water it decomposes rapidly. T. H. P.

Polyphosphates. NICOLA PARRAVANO and G. CALCAGNI (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 731—738).—The various supposed polyphosphates can be considered theoretically as formed by the union of pyrophosphate and metaphosphate in various proportions; thus the salt $Na_5P_3O_{10}$ is $Na_4P_2O_7+NaPO_3$, the salt $Na_6P_4O_{13}$ is $Na_4P_2O_7+2NaPO_3$, and so on. The authors have accordingly studied the freezing-point curve of mixtures of sodium pyrophosphate and metaphosphate in various proportions as well as the curve obtained with the corresponding potassium salts. Both curves consist of two continuous branches meeting at a eutectic point; the shape of the curves indicates the non-existence of any compounds of metaphosphate and pyrophosphate, so that the various polyphosphates which have been described are probably mere mixtures of the two salts.

W. A. D.

Action of Phosphoric Acid on Silicic Acid and Silicate Glass. KARL HÜTTNER (*Zeitsch. anorg. Chem.*, 1908, **59**, 216—224. Compare Mylius and Meusser, Abstr., 1905, ii, 316).—When finely-powdered silica is heated in a quartz vessel with excess of metaphosphoric acid, a clear solution is at first obtained, from which, on continued heating, silicyl phosphate, SiO_2,P_2O_5, separates in minute crystals (Hautefeuille and Margottet, Abstr., 1883, 782). The same compound is obtained by heating silicon chloride with phosphoric acid.

Silicyl phosphate is not decomposed by boiling water, but on heating strongly, it loses part of the phosphoric oxide and forms amorphous products, which are decomposed by water. The compound itself has also been obtained in an amorphous hydrated form from its solution in metaphosphoric acid, and this modification is being further investigated.

The action of phosphoric acid on the silicates found in glass has been investigated; in most cases, silicyl phosphate and metaphosphates are produced. Orthophosphoric acid scarcely acts on glass at the ordinary temperature, but does so at 100—150°. Phosphoric oxide can be sublimed in glass vessels without affecting them. G. S.

Silicic Acids obtained by Tschermak. JAKOB M. VAN BEMMELEN (*Zeitsch. anorg. Chem.*, 1908, **59**, 225—247; *Chem. Weekblad*, 1908, **5**, 567—589).—A criticism of the formulæ assigned to the silicic acids obtained by Tschermak (Abstr., 1905, ii, 816) by digesting natural silicates with hydrochloric acid. These formulæ are based on the changes which are observed in the rate of loss of water by the hydrogels when the proportion of water to silica has attained certain values. According to the author, these changes cannot be supposed to differentiate between the chemically-combined and the mechanically-held water, and furnish no basis for the deduction of formulæ for the various preparations of silicic acid. The hydrogels obtained from the silicates are colloidal absorption compounds of indefinite composition, and the changes in the rate of dehydration are probably due to changes in the mechanical structure of the hydrogels brought about by the gradual removal of water.

H. M. D.

Dissociation of Molten Silicates. II. CORNELIO DOELTER (*Monatsh.*, 1908, **29**, 607—644. Compare this vol., ii, 178).—The paper deals with the conductivity and the polarisation of augite, albite, labradorite, and diopside in the molten and in the solid states at high temperatures. In measuring the conductivity of molten salts, a sharper minimum in the telephone is obtained by using electrodes set far apart and placed in a liquid of small cross section. Since the use of capillary vessels is excluded on account of the viscosity of molten silicates, the author employs a conductivity trough of quartz and kaolin of parallelopiped shape, 24—25 mm. long and 1 sq. cm. in area, in which the electrodes are fixed as in his former experiments, not quite at the ends of the vessel. The trough is filled with the powdered silicate, and the conductivity measured at temperatures up to those at which the silicate sinters and fuses. Both direct and alternating currents have been employed, but measurements by the former are only of secondary importance, and do not agree with the values obtained with an alternating current, except in the case of augite.

Experiments, mainly of a qualitative nature to ascertain whether polarisation occurs in the solid as well as in the liquid state, indicate that such a phenomenon is not manifest in crystalline silicates unless the vitreous modification is also present; only in the neighbourhood of the m. p. does slight polarisation occur. For example, with augite, m. p. about 1200°, polarisation is not evident below 1180°, but becomes quite distinct at 1250°; albite, which is especially liable to resolidify in the vitreous state, shows polarisation at 900°, and with strong currents at 1100°, electrolysis occurs, aluminium being deposited on the platinum cathode.

From van't Hoff's equation: $d\log x/dT = -q/RT^2$ is derived the expression: $\log W = v/T + C$, according to which the graphic representaion of the relation between the logarithm of the specific resistance, $W(=1/x)$, and the reciprocal of the absolute temp., T (v and C being constants), is a straight line. The author's experiments show that the formula only holds for temperatures removed from the m. p.

The conductivity of a crystalline silicate first becomes measurable at about 500°, increases with the temperature, and shows a marked augmentation in the neighbourhood of the m. p., causing the conductivity-temperature curve to show a break; a gradual rounding of the curve is exhibited when the molten silicate passes into the vitreous form. In general, the temperature-conductivity curve consists of two parts, one, corresponding with temperatures from 200° below the m. p. up to the m. p., is nearly vertical, and the other, representing the conductivity of the liquid phase, is nearly horizontal. The fact that a crystalline silicate shows a sudden change in conductivity when passing into the liquid or into the amorphous state, is the most important result of the investigation. The paper concludes with theoretical discussions of the preceding fact and of the relation between crystalline structure and dissociation. C. S.

Search for Possible New Members of the Inactive Series of Gases. Sir William Ramsay (*Proc. Roy. Soc.*, 1908, **81**, *A*, 178—180. Compare following abstract).—As the periodic system would appear to indicate the existence of two or three elements of the helium group heavier than xenon, the heavier portions of the gas, after the fractional distillation of 120 tons of liquid air, were investigated by Moore (*loc. cit.*); no positive result was obtained, and it is probable that higher members either do not exist in the atmosphere or that they disintegrate during the process of separation.

It is suggested that the emanations from radium, thorium, and actinium may be the missing inactive elements. Some support is lent to this view by the fact that the atomic weight of radium emanation (deduced from diffusion experiments) appears to be about 172, so that it would fit into the vacant space below neon. The most recent experiments, however, indicate that the atomic weight of the emanation may be over 200, which would bring it into the same horizontal period as radium, thorium, and uranium. Nothing very definite is known as to the respective atomic weights of the thorium and actinium emanations. G. S.

Heavy Constituents of the Atmosphere. Richard B. Moore (*Proc. Roy. Soc.*, 1908, **81**, *A*, 195—209).—The heavy gases from about 120 tons of liquid air have been examined for the presence of gases heavier than xenon, with negative results.

In the first experiment, the heavy residues from 19 tons of liquid air were condensed in liquid oxygen. After most of the oxygen had evaporated, the remainder was removed by means of melted phosphorus, and the nitrogen and other impurities were also removed by means of the appropriate reagents. The residue (about 6 litres of inactive gas) was then fractionated, but the final fraction was not heavier than xenon, and the spectrum afforded no evidence of the presence of a new gas. The water with which the gas had been in contact was boiled, and the gas given off added to the main bulk before fractionation.

In a second experiment, the residues from 100 tons of liquid air were worked up by a modified method, in which the gases did not come into contact with much water, but the results were negative in this case also. The methods of fractionation employed are fully described.

The magnesium and lime used to extract the nitrogen were examined to detect possible reaction products, with negative results. G. S.

New Reaction for the Production of Sodium Carbonate. D. Crispo (*Bull. Soc. chim. Belg.*, 1908, **22**, 292—295).—The author finds that, contrary to previous statements, sodium carbonate can be rapidly and easily prepared by the interaction, under suitable conditions, of calcium carbonate and sodium silicate. A syrup of sodium metasilicate is heated with chalk, the mass is then dried at a moderate temperature, and lixiviated with water to remove the sodium carbonate. The polysilicate, $3SiO_2,Na_2O$, does not react with calcium carbonate.

Details are given of an industrial process for preparing the metasilicate from sodium sulphate by heating this salt with charcoal and sand. W. O. W.

The Reciprocal Salt Pair $NaCl-K_2SO_4$; $KCl-Na_2SO_4$. Ernst Jänecke (*Zeitsch. physikal. Chem.*, 1908, **64**, 343—356. Compare this vol., ii, 808).—The freezing-point and transformation curves of the four binary systems concerned confirm earlier results ($KCl-K_2SO_4$ and $NaCl-Na_2SO_4$, Ruff and Plato, Abstr., 1903, ii, 588; $NaCl-KCl$, Kurnakoff and Schemtschuschny, Abstr., 1906, ii, 443; $K_2SO_4-Na_2SO_4$, Nacken, Abstr., 1907, ii, 611). The formation of a compound of sodium and potassium sulphates in the solid state, assumed by Nacken, is not confirmed.

The results are recorded in a space model, the base of which is a square representing the proportions of the four salts present, and the ordinates are the temperatures of solidification. Two classes of mixed crystals are formed, and a minimum freezing point is found at the composition $(Na_2)_{43}(K_2)_{57}(Cl_2)_{46}(SO_4)_{54}$. C. H. D.

The Silver Hydrogel in Photographic Films. Lüppo-Cramer (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 33—36).—Silver nitrate is reduced by pyrogallol and sodium carbonate to a black, finely-divided silver, which is quickly bleached by mercuric chloride, whereas pyrogallol alone gives a light-coloured, coarse-grained precipitate, to which mercuric chloride gives a dark colour. The author has tried many other reducing agents. In general, reduction in presence of a solvent of the silver salts, such as sodium sulphite, thiosulphate, or thiocyanate, or ammonia, tends to give the light-coloured silver, whilst any circumstance which tends to prevent the coalescence of the reduced silver, for example, reduction of an insoluble silver salt or enclosure of the salt in a gelatin film, yields the dark-coloured modification. The silver hydrogel of the photographic film is the dark-coloured form. Collodion does not hinder the coalescence of the silver particles to nearly the same extent as gelatin. T. E.

Decomposition of Certain Salts of Silver. Angelo Angeli and Guerriero Marchetti (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 695—697).—Whereas the sodium salt of nitrohydroxylamic acid decomposes into sodium nitrite and hyponitrite, thus: $2NaON\colon NO_2Na = NaO\cdot N\colon N\cdot ONa + 2NaNO_2$, the silver salt gives silver nitrite, nitric oxide, and silver according to the equation: $AgON\colon NO_2Ag = NO_2Ag + NO + Ag$. It is possible that the group NOAg is first eliminated and then decomposed; this view is strengthened by the fact that benzenesulphydroxamic acid, which is decomposed by alkalis into benzenesulphinic acid and a hyponitrite, gives an unstable silver salt, which readily forms silver sulphinate, nitric oxide, and silver:

$$OAg\cdot SO(C_6H_5)\colon NOAg = C_6H_5\cdot SO_2Ag + NO + Ag.$$

Pernitrosocamphor gives a yellow silver derivative, which soon blackens, owing to the formation of silver and a *substance*, $C_{10}H_{15}O_2N_2$, which melts at 168°; the change occurring is: $2C_{10}H_{15}O_2N_2Ag = 2C_{10}H_{15}O_2N_2 + Ag_2$. W. A. D.

Crystallisation of the Alkaline-earth Oxides, especially of Calcium Oxide, from their Nitrates.

Gottfried Brügelmann (*Zeitsch. anorg. Chem.*, 1908, **59**, 248—270).—When the carefully-purified nitrates of calcium, strontium, and barium are heated to the temperature of decomposition, the corresponding oxides separate out in the form of regular cubes. Calcium and strontium oxides yield well-developed macroscopic crystals. The formation of the calcium oxide crystals is greatly facilitated by the addition of 0·25% to 0·6% of calcium hydroxide to the molten nitrate.

The author's very numerous experiments lead to the conclusion that the usual precautions adopted for the production of well-developed crystals (the use of large quantities of material, slow cooling, and freedom from mechanical disturbance) are not the only important factors of importance. A study of the crystallo-genetic peculiarities is essential. H. M. D.

Relation of Changes of Solubility of Calcium Sulphate and its Rate of Hydration.

Paul Rohland (*Zeitsch. Elektrochem.*, 1908, **14**, 421—422).—The effect of twenty-two substances on the rate of hydration of gypsum is tried. Those which increase the solubility of the gypsum in water, also increase its rate of hydration, and vice versâ. The same substance may have opposite effects, for example, gypsum is less soluble in dilute solutions of sodium, ammonium, and magnesium sulphates than it is in water, whereas it is more soluble in strong solutions. Hydration is retarded by dilute solutions, and accelerated by strong ones. T. E.

Preparation of Colloidal Amorphous Forms of Crystalline and Soluble Salts of the Alkaline-earth Metals.

P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 89—91).—Gelatinous precipitates are obtained in general by rapid separation of a substance from a solution in which it is very sparingly soluble. High viscosity of the solvent is also favourable. The thiocyanate of an alkali or alkaline-earth metal is dissolved in a mixture of amyl alcohol and ether, and mixed with a similar solution of an acid. In this way the following salts have been obtained in the gelatinous form: potassium, sodium, ammonium, calcium, strontium, and barium chlorides, bromides, and nitrates, and the sulphates of potassium, sodium, and ammonium. The sulphates and phosphates of the alkaline-earth metals are obtained in the gelatinous form from solutions in any of the lower aliphatic alcohols. T. E.

Isomorphism of Calcium and Manganese Bisilicates.

A. S. Ginsberg (*Zeitsch. anorg. Chem.*, 1908, **59**, 346—363).—A freezing-point curve for the system wollastonite-rhodonite has been obtained by observations on mixtures containing different proportions of the two silicates. Calcium silicate melts at 1512°; manganese silicate at 1218°. The temperatures corresponding with the commencement of crystallisation and with complete solidification are given for a series of mixtures. The minimum temperature of 1180° corresponds with a mixture containing 12·8 molecular % of calcium silicate.

From the nature of the freezing-point diagram, the conclusion is drawn that the two silicates form a complete series of mixed crystals, and that wollastonite and rodonite are isomorphous. Since rhodonite is triclinic, the existence of a polymorphic, monoclinic modification must be assumed in order to explain the formation of the monoclinic series of mixed crystals, with which the mineral bustamite is to be identified.

Measurements of the density and hardness of mixtures containing various proportions of the two silicates have been made, which show that these properties vary continuously with the composition. The curve representing the hardness as a function of the composition exhibits a maximum for a mixture containing 15% manganese silicate. The density of wollastonite is 2·919, and that of rhodonite 3·350.

H. M. D.

Action of Soluble on Insoluble Substances. William Oechsner de Coninck and L. Arzalier (*Bull. Acad. roy. Belg.*, 1908, 577—578. Compare Abstr., 1907, ii, 952).—When barium sulphate (1 mol.) is heated at 100° for 620 hours with methylamine hydrochloride (2 mols.) in aqueous solution, a partial double decomposition ensues. A similar result was also obtained in the case of barium sulphate (1 mol.) and an aqueous solution of potassium chloride (2 mols.) at the end of five months, heated at 90—95° during two-fifths of the period. M. A. W.

Action of Soluble on Insoluble Substances. William Oechsner de Coninck and L. Arzalier (*Bull. Acad. roy. Belg.*, 1908, 607—608). —Pure strontium carbonate, shaken with a concentrated solution of potassium chloride gives, in four months, a solution containing strontium chloride. E. H.

Microscopic Study of Mortar. Gino Gallo (*Gazzetta*, 1908, 38, ii, 142—156. Compare Stern, this vol., ii, 589).—Microscopic study of the changes occurring in a mortar shows that the absorption of carbon dioxide by the calcium hydroxide present is intimately related to the presence of water, and, since the calcium carbonate formed is distinctly crystalline, it is concluded that both the lime and the carbon dioxide must be in solution before the reaction takes place. A mortar prepared with a deficit of water lacks solidity and has low resisting properties, owing to the fact that the calcium carbonate formed under these conditions forms a coarse net-work; similar defects are observable in mortar made with coarse sand, the calcium carbonate deposited in the large interstices not adhering to all the neighbouring sand granules.

The injurious effect exercised by the presence of magnesia in a mortar is explained by the slight solubility of the magnesia in the water present and by the slow absorption of carbon dioxide by the solution formed.

When the water is completely eliminated from a mortar, chemical action ceases, and in the interior of old mortars in which the carbon dioxide could not reach the lime before the water evaporated completely, free lime is found. T. H. P.

Microscopic Study of Mortar and Pozzuolana. GINO GALLO (*Gazzetta*, 1908, 38, ii, 156—204).—The author reviews briefly previous work on pozzuolana and its value as a hydraulic mortar. His own experiments on the setting of mortars prepared from pozzuolana were made with the microscope (see preceding abstract).

All the mortars examined exhibited a distinctly crystalline border of calcite, which forms immediately the mortar is made, and has a thickness of about 0·1 mm.; when good pozzuolana is employed, the thickness of this layer does not change appreciably. This calcitic coating prevents water from finding ready access to the interior of the mortar, and so hinders the solution and removal of the lime.

The first phenomenon observable in the setting of these mortars is the hydration, by means of the lime water, of the silica and alumina, which swell so as to fill the whole space previously occupied by air and water, and yield an impermeable mass bestowing resistance on the mortar. Then follows the formation of soluble calcium aluminate, which, in presence of excess of lime and in supersaturated solution, deposits crystals of the calcium aluminate, $Al_2O_3,3CaO,10H_2O$, which is stable only in presence of calcium hydroxide solution, and is decomposed by water; this crystallisation binds together the various particles which exist as inclusions in the crystals. The limiting surfaces between the flocculent portions and the spaces left by these then become the seat of capillary forces, by means of which the silica attracts the lime into its pores and thus forms nodules in which the lime gradually gives up its water of hydration and crystallises as calcium monohydrate, thus determining complete adhesion of the various parts. The more rapidly the swelling attains its maximum and the greater the latter, the more satisfactory will be the setting of the mortar.

The increases in volume of various specimens of pozzuolana in presence of calcium hydroxide solution have been measured. It is found that this increase is related directly to the amount of lime absorbed, and that it is considerably increased by renewing the calcium hydroxide solution from time to time. The action of calcium hydroxide also causes an increase in the amounts of alumina and silica which can be dissolved by dilute acid.

The value of a pozzuolana for the preparation of hydraulic mortar may be determined by the following measurements: (1) Increase of volume with calcium hydroxide solution. (2) Electrical conductivity (compare Giorgis and Gallo, Abstr., 1906, ii, 447). (3) Amounts of silica and alumina dissolved by treating with 5% sodium hydroxide solution on the water-bath for fifteen minutes. For good pozzuolana, these amounts are almost constant, even where the material has been previously treated with dilute acid; but for inferior materials, such as ashes from Vesuvius and Bassano, previous disgregation with hydrochloric acid renders increasing amounts of silica and alumina capable of solution in 5% sodium hydroxide solution. T. H. P.

Liquefaction and Sublimation of Certain Sulphides. WILHELM BILTZ (*Zeitsch. anorg. Chem.*, 1908, **59**, 273—284).—The sulphides, contained in porcelain or magnesia tubes through which a current of dry nitrogen was passed, were heated by means of an electrical resistance furnace. The sublimation or liquefaction was observed by means of a telescope, the temperature being registered by a thermo-element or a Wanner pyrometer. The following melting points are recorded: synthetic lead sulphide, 1100°, sublimation commencing at 950°; galena from Freiberg, 1112° ± 2°; ferrous sulphide, 1197° ± 2°; nickel sulphide, 797° ± 2°; cobalt sulphide, $>1100°$. Zinc, cadmium, and mercuric sulphides sublime without melting. The temperatures at which sublimation begins are as follows: zinc blende from Santander, 1178° ± 2°; synthetic zinc sulphide in the form of wurtzite, 1185° ± 6°; cadmium sulphide, 980°; cinnabar and precipitated mercuric sulphide, 446° ± 10°.

Stannous sulphide exhibits two melting points. Its behaviour was traced by a study of cooling and heating curves. The lower melting point is about 870°, and, as the temperature is raised from 1000° to 1100°, the viscosity of the liquid increases very quickly, so that at the latter temperature the substance exhibits the properties of a solid. At about 1200°, liquefaction again takes place. The phenomenon has not yet been explained. H. M. D.

Compounds of Lead with Nitrous Acid. ALBERTO CHILESOTTI (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 824—834).—The author gives a résumé of the various lead nitrites which have been described, many of which are probably not individual compounds.

By mixing equivalent proportions of solutions of lead chloride and silver nitrite saturated at 25° and concentrating the liquid, first by freezing and then by evaporation over sulphuric acid, he has obtained the hydrate, $Pb(NO_2)_2,H_2O$ (compare Lang, *J. pr. Chem*, 1862, **86**, 300), and the anhydrous salt, $Pb(NO_2)_2$, mixed with a little lead oxide and lead nitrate. The electrical conductivity of lead nitrite solutions at 25° is as follows:

v =	16	32	64	128	256	512	1024
Λ =	59·4	72·3	85·5	98·9	111·3	122·1	129·7

For the more concentrated solutions, the conductivity of the nitrite is somewhat less than that of the nitrate or chloride, but at greater dilutions the differences are small. The value of $\Lambda_{1024} - \Lambda_{32}$ is 27·6 for the nitrate, 42·1 for the chloride, and 57·4 for the nitrite. It is probable, from their conductivity and from their intense yellow colour, that solutions of lead nitrite contain complex anions of the type $Ag(NO_2)_2'$ or $Hg(NO_2)_4''$ (compare Abegg and Pick, Abstr., 1906, ii, 833). T. H. P.

Planimetric Analysis of Alloys and the Structure of Phosphor Copper. Alfred K. Huntington and Cecil H. Desch (*Trans. Faraday Soc.*, 1908, 4, 51—58).—The method depends on the measurement, by means of a planimeter, of the relative areas occupied by the different constituents on a polished and etched section of an alloy. It is applicable to alloys for which two solid constituents are visible in the same section, and often also when crystals of a solid constituent are surrounded by a eutectic, but is only to be employed when the alloys are in a known state of equilibrium.

In making an observation, the highly magnified image of the section is projected on a sheet of paper, the outlines of one of the constituents traced with a pencil, and the crystals shaded. A boundary line is drawn to enclose the pattern to be measured, and the shaded area measured with the planimeter. The agreement of planimetric and ordinary analysis for the alloys of copper and aluminium is excellent. The chief recommendation of the method is its rapidity.

When the pattern is very complicated, or made up of many small and detached portions, better results are obtained by dividing the field into squares, estimating the relative shaded areas, and averaging.

Heyn and Bauer, who have investigated the phosphor-copper alloys (Abstr., 1906, ii, 855), observed that the copper areas determined planimetrically were larger than calculation from the composition would indicate. The alloys in question (up to 8% phosphorus) consist mainly of copper crystals and a eutectic copper—copper phosphide, and it is now shown that the difference is due to the fact that the crystals of copper gradually increase in size after solidification by withdrawing copper from the eutectic surrounding them, so that each crystal is surrounded by a clear belt free from copper. The areas of these belts have been determined, and when a corresponding correction is applied to the areas of the copper crystals, the results of the planimetric and direct analysis show excellent agreement.

The paper is illustrated with photomicrographs. G. S.

Constitution of the Copper-Zinc-Nickel Alloys, and of the Binary Systems Copper-Nickel, Copper-Zinc, and Nickel-Zinc. Victor E. Tafel (*Metallurgie*, 1908, 5, 343—352, 375—383, 413—430).—The study of the copper-nickel equilibrium diagram completely confirms the results of Guertler and Tammann (Abstr., 1907, ii, 174). The results obtained for the copper-zinc series differ somewhat from those of Shepherd (Abstr., 1904, ii, 662). The existence of the compound Cu_2Zn_3 (m. p. 830°) is established, and that of the compound Cu_2Zn, indicated by other methods, is quite consistent with the thermal diagram. The compounds $CuZn_6$, $CuZn_4$, $CuZn_3$, $CuZn_2$, and CuZn, described by various authors, certainly do not exist. The alloys, especially in the neighbourhood of 50% Zn, have considerable tendency to liquate.

The nickel-zinc alloys (this vol., ii, 105; compare Voss, *ibid.*, ii, 197) have been more fully investigated. The only compound recognised is $NiZn_3$, a highly brittle substance giving a characteristic coloration with dilute nitric acid. Owing to loss of zinc by volatilisation, it was found necessary to complete the diagram above 50% Ni by extrapolation from the ternary model.

Alloys of copper, nickel, and zinc liquate considerably, the lower portions of the ingots becoming generally richer in nickel. The thermal diagram, constructed as a projection on a triangular base, represents determinations of 92 different alloys. Neither a ternary compound nor a ternary eutectic point was found. The surface of the temperature-concentration model consists of three surfaces, each representing the separation of a series of primary mixed crystals. The third of these, the richest in zinc, is separated from the second by a eutectic line. The observations have also been plotted in the form of vertical sections through the model, the complicated changes taking place in the solid alloys being also represented in this way.

The alloys of technical importance, such as German silver, consist of homogeneous mixed crystals. Alloys containing 15·3—20% Ni, 73—80% Cu, and 7% Zn have a remarkable resemblance to silver, both in their colour when polished and in ductility.

The structure of the alloys, and the transformations undergone during cooling, are illustrated by fifty photomicrographs.

C. H. D.

Cuprous Ammonia Halides. STEWART J. LLOYD (*J. Physical Chem.*, 1908, **12**, 398—403).—Evidence of the existence of various cuprous ammonia halides was obtained by saturating the cuprous halides at 0° with dry ammonia, and measuring the vapour pressure at a constant temperature as the ammonia was gradually removed. The curves, obtained by plotting vapour pressures against the ammonia content of the halides, show discontinuities in the vapour pressure corresponding with the following compounds, of which the colour and the approximate melting point are recorded: $Cu_2I_2,6NH_3$, light green, 105°; $Cu_2I_2,3NH_3$, dark brown, 117°; $Cu_2Br_2,6NH_3$, green, 115°; $Cu_2Br_2,3NH_3$, brown, 135°; $Cu_2Cl_2,6NH_3$, green, 123°; $Cu_2Cl_2,3NH_3$, light brown, 144°; Cu_2Cl_2,NH_3, dark brown, 162°. Tables are given which show the vapour pressures of the seven compounds at a series of different temperatures. H. M. D.

Dissociation Pressures of Certain Oxides of Copper, Cobalt, Nickel, and Antimony. HARRY W. FOOTE and E. K. SMITH (*J. Amer. Chem. Soc.*, 1908, **30**, 1344—1350).—The dissociation pressures of cupric oxide, cuprous oxide, cobalto-cobaltic oxide, cobaltous oxide, nickelous oxide, and antimony tetroxide have been measured at temperatures between 800° and 1245°. When possible, the temperature has been determined at which the dissociation pressure equals the pressure of the oxygen in the air. Cupric oxide gives this pressure at about 1025°, cobalto-cobaltic oxide at about 905°, and antimony tetroxide at about 950°. The dissociation pressure of cuprous oxide does not exceed 1 mm. at 1020°. Pure cobaltous oxide does not show a dissociation pressure at 1100°.

The dissociation pressures of cupric oxide and nickelous oxide calculated by Stahl (*Metallurgie*, 1907, **4**, 682) from Nernst's formula are much lower than those now obtained by direct measurement.

E. G.

Reduction of Fehling's Solution to Metallic Copper. Deposition of Copper Mirrors on Glass. PUNCHANAN NEOGI (*Zeitsch. anorg. Chem.*, 1908, **59**, 213—215).—To obtain a mirror by reduction of Fehling's solution, the copper sulphate solution is poured into a beaker, the tartrate solution added until the precipitate at first formed just disappears, a considerable amount of formaldehyde is then added, the beaker inclined, and heated on one side until the deposition of copper just begins. On rotating the beaker, a mirror forms all over the inner surface. One of the precipitates thus produced contained 98·6% of copper. G. S.

Oxidation by means of Cuprous Oxide in Strongly Alkaline Solution. RICHARD EHRENFELD (*Zeitsch. anorg. Chem.*, 1908, **59**, 161—182).—An attempt was made to estimate cupric salts volumetrically by reducing them completely to the cuprous form by the action of an arsenite in strongly alkaline solution, the excess of arsenite being determined by titration with iodine, but the results came out about 6% too high. This result is due to the simultaneous oxidation of part of the arsenite by the oxygen of the air under the catalytic influence of cuprous oxide.

In the absence of a reducing agent, cuprous oxide in the presence of strong alkali undergoes autoxidation, and more than the theoretical amount of oxygen required for the formation of cupric oxide is absorbed. It is probable that the excess of oxygen goes to the formation of hydrogen peroxide, which is, however, immediately used up in oxidising more cuprous oxide. Autoxidation of cuprous oxide also takes place in the presence of concentrated sulphuric acid, excess of oxygen being absorbed and hydrogen peroxide formed.

Strongly alkaline solutions of antimony trichloride behave exactly like arsenite solutions, and the oxidation of alkaline sodium sulphite and stannous chloride solutions is also accelerated by cuprous oxide. In the latter case, however, only the theoretical volume of oxygen is absorbed. On the other hand, cuprous oxide does not accelerate the oxidation of chromic sulphate, potassium nitrite, potassium phosphite, or potassium hypophosphite in alkaline solution. Potassium phosphite and hypophosphite and sodium sulphite are more readily acted on by the oxygen of the air in aqueous than in strongly alkaline solution.
G. S.

Solubility of Precipitated Basic Copper Carbonate in Solutions of Carbon Dioxide. E. E. FREE (*J. Amer. Chem. Soc.*, 1908, **30**, 1366—1374).—In connexion with a study of the effect of mine detritus in irrigation waters, it was found necessary to ascertain the solubility of precipitated basic copper carbonate in water containing varying amounts of carbon dioxide, and the influence of certain salts on it. The precipitate obtained on mixing solutions of copper sulphate and sodium carbonate is at first pale bluish-green, but gradually loses carbon dioxide and becomes of a malachite-green colour. The latter product is regarded by Gröger (Abstr., 1900, ii, 542) as the compound $6CuO,3CO_2,4H_2O$. It has now been found that the substance is of variable composition, and is so changed by the action of carbon dioxide and water that it gradually becomes less soluble in the carbon dioxide solution. On repeatedly treating such precipitates with solution of carbon dioxide of 0·12% strength, they finally reach a constant solubility of about thirty-five parts per million, but the solubility increases with the concentration of the carbon dioxide. The solubilities are but little changed by the addition of small quantities of sodium chloride or sulphate, but are increased by larger amounts of these salts. Sodium and calcium carbonates decrease the solubility greatly, but calcium sulphate does not cause a decided change in either direction. E. G.

Resolution of Ytterbium into its Components. Georges Urbain (*Chem. Zeit.*, 1908, 32, 730).—The author disputes Welsbach's claim for priority, and states that the decomposition products, neoytterbium and lutetium, which he obtained (Abstr., 1907, ii, 956) are identical with those of Welsbach, called by him aldebaranium and cassiopeium (this vol., ii, 591). J. V. E.

Interaction of Aluminium-Powder and Carbon. Frank E. Weston and H. Russell Ellis (*Trans. Faraday Soc.*, 1908, 4, 60—71. Compare Fichter, Abstr., 1907, ii, 691).—The interaction of finely-powdered aluminium and finely-powdered wood-charcoal, sugar-charcoal, and graphite has been investigated. In all cases, mixtures could be prepared which, when started with a fuse of magnesium and barium peroxide, reacted with vivid incandescence, like the ordinary thermit reaction. Some mixtures, when raised to a dull red heat in a closed crucible, reacted vigorously on exposure to the air.

In all cases the reaction product contained aluminium carbide, nitride, and oxide, as well as the free elements. As the only hydrocarbon obtained by the action of water or hydrochloric acid on the product is methane, it is probable that the only carbide formed is Al_4C_3.

The authors consider that the air plays a prominent part in the phenomenon, that the first action is the oxidation of the carbon to monoxide and dioxide, the heat given out starts the oxidation of the aluminium, and, finally, the latter reaction raises the temperature sufficiently to bring about combination of the aluminium with carbon and nitrogen. Among other reasons in support of this view, it was found that, when the air was withdrawn from the mixtures by means of a Töpler pump, it was much less easy to initiate combination. G. S.

Corrosion of Iron by Water and Water Solutions. E. Heyn and O. Bauer (*Chem. Zentr.*, 1908, i, 2063—2065; from *Mitt. K. Mat.-prüf.-Amt, Gross-Lichterfelde*, 1907, 26, 1—104. Compare Friend, this vol., ii, 698).—*A. Influence of Oxygen and Carbon Dioxide on the Corrosion of Iron by Water and by Water Solutions.*—The rusting was estimated by allowing small, weighed wrought-iron plates to rust when suspended in Charlottenburg conductivity water, or aqueous solutions contained in a glass beaker, and re-weighing them after removing the rust. Air was allowed free access to the iron and water; in some cases, it was drawn through the liquid, and the temperature was that of the ordinary room. The results obtained support the conclusions of Traube (Abstr., 1885, 1105) and Dunstan (Trans., 1905, **87**, 1548), that carbon dioxide is not needful, but the presence of free oxygen is a necessary condition for the process of rusting; also, that the iron does not derive oxygen from the water, but from the atmosphere. After discussing the conditions that influence the rate of rusting, the authors cite some experiments which show that the addition of hydrogen peroxide does not increase the rate of rusting so much as does drawing air through the liquid in which the iron is suspended.

B. Rusting Influenced by the Iron being in Contact with other Metals.—Copper when in contact with the iron is found to increase the rusting 25% when suspended in conductivity water and 47% in artificially-prepared sea-water. In contact with nickel, iron rusts 14—19% more than it does by itself, and ingot-iron in contact with cast-iron rusts less readily than when by itself, whilst the cast-iron rusts more readily by about 50%. It is found that iron in contact with a more positive metal, suspended in a liquid causing rusting, rusts less readily, and when in contact with a more negative metal, rusting takes place more readily than when iron is exposed under similar conditions by itself.

C. Comparison of the Rusting of Various Kinds of Iron by Water.—The results show that a content of 0·46 to 3·08% of manganese and 0·072 to 3·38% of phosphorus has very little influence on the rate of rusting.

D. Influence of Various Liquids on the Rusting of Iron at the Ordinary Temperature.—It is found that very dilute solutions of simple electrolytes generally cause iron to rust more slowly than does distilled water alone; with increase of concentration, however, the rusting increases, reaching a maximum and then decreasing slowly. The solutions showing maximum activity are called "critical solutions," and generally cause iron to rust more readily than distilled water. Exceptions to this, however, are solutions of potassium chloride, sodium chloride, potassium sulphate, sodium hydrogen carbonate, sodium sulphate, calcium chloride, and barium chloride, the activity of which is less than that of distilled water. Ammonium nitrate solution and a saturated solution of diammonium hydrogen phosphate cause iron to rust, probably owing to their decomposition, and thus appear to contradict the previous conclusion *A*; the behaviour of the "critical solution" of diammonium hydrogen phosphate is also abnormal.

In the case of certain salt solutions when the concentration is increased beyond the "critical concentration," the rusting is very rapidly decreased, until a concentration is reached where no rusting takes place; such solutions are called "limiting solutions." Diammonium hydrogen phosphate again behaves in a distinctive manner, having a second limiting concentration, and, finally, in still more concentrated solutions, iron is dissolved with liberation of a gas.

E. Electrical Potential between Iron and Various Liquids.—This section not being suitable for abstraction, the original should be consulted. J. V. E.

Alloys of Iron, Silicon, and Carbon. W. GONTERMANN (*Zeitsch. anorg. Chem.*, 1908, **59**, 373—413).—The investigation covers that portion of the iron-carbon-silicon system which includes the components $Fe-Fe_3C-FeSi$. Pure iron-carbon alloys were fused with silicon in porcelain tubes in an atmosphere of purified nitrogen. Repeated melting was sometimes necessary to ensure homogeneity.

Iron containing only 0·7% carbon exhibits a transformation point at 1411°, which appears on both the heating and cooling curves, and does not disappear on re-heating, but is absent from alloys containing even a slightly larger proportion of carbon. Owing to undercooling, alloys containing 3—4% C may contain both structurally-free martensite and cementite. A hypothetical equilibrium curve is suggested for the iron-carbon alloys, assuming the existence of two immiscible liquid phases above 3—4% C, one of which readily sets free graphite. The behaviour of white and grey cast-irons may be explained on this assumption. The transformation observed at 800° may be the eutectoid point of β-iron and graphite. Slight modifications are also suggested in the iron-silicon diagram (compare Guertler and Tammann, Abstr., 1906, ii, 32).

The ternary equilibrium is represented by projections on the base of the space-model. The freezing points lie on two surfaces, on one of which an $Fe-C-Si$ solid solution separates (silicon-martensite), and on the other an $Fe_3C-FeSi$ solid solution (silicon-cementite), the two intersecting along a eutectic line. At lower temperatures, the stable system consists of silicon-ferrite and graphite, but the reaction is slow and the development of heat very small, so that the exact position of the curve of separation of graphite could not be determined. The only part of the metastable system which could be satisfactorily followed was the eutectoid line between silicon-ferrite and silicon-cementite (silicon-pearlite). Alloys consisting of unsaturated silicon-martensite undergo the metastable change on cooling under the conditions adopted, whilst saturated silicon-martensite, or a mixture of this with silicon-cementite, sets free graphite (stable change) if the silicon-content exceeds 1%. Silicon-cementite containing more than 20% Si does not undergo transformation in the solid state.

C. H. D.

The Thomas Steel Process. F. WUST and L. LAVAL (*Metallurgie*, 1908, **5**, 431—462, 471—489).—The relative rate of oxidation of the various elements present in pig-iron during the Thomas basic steel process has been studied experimentally. From 8 to 10% of iron is lost during oxidation, mostly during the last stage of the process, when the last traces of phosphorus are being removed. This increases with rise of temperature, the tendency of iron to oxidise increasing more rapidly with temperature than that of phosphorus. The conditions are not altered by drying or heating the air supply. Curves are given showing the change in composition of metal and slag during the process.

The changes in structure of the alloys are illustrated by photomicrographs. The original phosphoretic iron contains crystals of cementite and martensite and a ternary cementite-martensite-phosphide eutectic, as well as well-formed crystals of sulphide. With progressive elimination of carbon, the ternary eutectic is replaced by a binary martensite-phosphide eutectic. C. H. D.

Dissociation Pressures of Ferric Oxide. PERCY T. WALDEN (*J. Amer. Chem. Soc.*, 1908, **30**, 1350—1355).—Determinations of the dissociation pressures of ferric oxide have been made at temperatures between 1100° and 1400°. At 1350°, the pressure is approximately equal to that of the oxygen in the air. Ferrosoferric oxide does not show any dissociation pressure at 1350°.

By heating cuprous oxide with ferric oxide, Stahl (*Metallurgie*, 1907, **4**, 688) obtained a strongly magnetic product, and concluded that the following reaction had occurred: $Cu_2O + 3Fe_2O_3 = 2CuO + 2Fe_3O_4$. It is now shown that this magnetic substance was probably the compound $CuFe_2O_4$ described by List (Abstr., 1879, 13). It is probable that there is another magnetic double oxide of iron and copper which has not yet been described, and work on this and similar substances is in progress. E. G.

Ferrinitrososulphides. LIVIO CAMBI (*Atti R. Accad. Lincei*, 1908, [v], 720—724).—A theoretical paper in which facts already abstracted (Abstr., 1907, ii, 960; this vol., ii, 41, 288) are discussed at length with particular reference to the views of Bellucci and Cesaris (Abstr., 1907, ii, 29, 472; this vol., ii, 111, 499, 593).

W. A. D.

Gases Occluded in a Special Nickel Steel. G. BELLOC (*Compt. rend.*, 1908, **147**, 244—245. Compare this vol., ii, 108).—The proportion and nature of the gases occluded by a nickel steel containing about 45% of nickel and 0·15% of carbon have been determined by the method described previously. The occluded gases consist of carbon monoxide and dioxide, hydrogen, and nitrogen, the first being completely evolved below 520°, whilst the last only commences to be evolved above this temperature. Different results are obtained according as the steel is in the form of wire or shavings. In the latter case, the total gas evolved is 3·5 times the volume of the alloy; the curve obtained by plotting the variation of the volume of the gas evolved with the temperature (dv/dt) against the temperature (t) is sensibly parallel to the temperature axis, and the proportion of carbon monoxide increases up to 75%, whilst the maximum amount of hydrogen is evolved at 540°, above which the volume of hydrogen produced gradually decreases. With the wire the total volume of gas evolved is ten times that of the metal; the curve (in t, dv/dt) exhibits well-defined maxima at 540° and 830°, and the variations in composition of the gas are no longer gradual; thus at 540° a minimum proportion of carbon monoxide and a maximum of hydrogen are observed, whilst above this temperature the carbon monoxide increases somewhat irregularly. The mean proportion of hydrogen is greater than from the shavings.

This alloy belongs to the type termed by Guillaume "reversible," the limits of its gradual transformation being 350° and 400°. The greater part of the gases is evolved while the iron is in the γ-state and the nickel in the β-state, from which would be expected a gradual alteration in the composition and volume of the gas evolved. The latter is the case with shavings, and the different behaviour of the wire indicates an alteration in its molecular state. The difference in absolute volumes of the gas evolved from shavings and from wire can be explained either by (1) unequal distribution in the ingot, or (2) large mechanical loss of occluded gas in turning, or (3) absorption of gas during the manufacture of the wire. E. H.

Action of Arsenic Chloride and Arsenic on Cobalt. F. DUCELLIEZ (*Compt. rend.*, 1908, **147**, 424—426).—By the action of arsenic chloride, metallic cobalt is transformed into a mixture of chloride and arsenide, the composition of the latter ranging from $CoAs_2$ to Co_3As_2 according as the temperature of the reaction is increased. When mixtures of arsenic chloride with cobalt or alloys of arsenic and cobalt, or mixtures of arsenic and cobalt (both components being powdered), are heated in an inert atmosphere (hydrogen or carbon monoxide), or when powdered cobalt is heated in a current of hydrogen containing arsenic vapour, the following results are obtained. Between 800° and 1400°, *tricobaltdiarsenide*, Co_3As_2, is formed, and above 1000° is obtained as brilliant ingots, D^0 7·82, which lose arsenic about 1400°. From 600° to 800°, cobalt or the arsenide, Co_3As_2, is converted into *cobalt arsenide*, CoAs, a grey, crystalline powder, D^0 7·62, which tarnishes slightly in the air, and when heated in a current of hydrogen commences to lose arsenic at 800° without melting. At 400—600°, the final product contains 65·6% of arsenic corresponding with the composition Co_2As_3; it has D^0 7·35, and commences to decompose at 600°. Below 400°, the preceding compound is slowly transformed into smaltine, $CoAs_2$, which is not directly obtained at these temperatures by the action of arsenic trichloride on cobalt. The product is a grey powder, D^0 6·97, oxidised by the air, and decomposed slightly above 400°. In the experiments above 600°, a little arsenic is set free, the amount increasing with the temperature. In the first two series of experiments, after the arsenide is formed, continued action of arsenic chloride results in the formation of cobalt chloride and liberation of arsenic, the weight of the compound diminishing. In the last two cases, arsenic is not deposited or cobalt chloride formed after the production of Co_2As_3 or $CoAs_2$.

The compound Co_3As_2 can also be prepared by reducing cobalt arsenate or arsenite with hydrogen at 900°; the heat developed, volatilising part of the arsenic, prevents the formation of cobalt arsenide, CoAs.

The arsenides described are non-magnetic, and their densities are much higher than those found by calculation for mixtures. They are violently attacked by chlorine, oxygen, and sulphur, readily dissolved by nitric acid and aqua regia, and slowly attacked by fused alkalis and alkali carbonates, but hot concentrated hydrochloric acid has very little action, and sulphuric acid still less. E. H.

Alloys of Cobalt with Tin, Antimony, Lead, Bismuth, Thallium, Zinc, Chromium, and Silicon. KURT LEWKONJA (*Zeitsch. anorg. Chem.*, 1908, **59**, 293—345).—Freezing-point curves of mixtures of the metals have been obtained and the micro-structure of the solidified products examined.

Cobalt and tin are miscible in all proportions in the liquid condition. The compounds Co_2Sn, m. p. 1151°, and CoSn, which melts with decomposition at 943° and undergoes a polymorphic change at 526°, are formed. In the solid condition, the maximum amount of tin dissolved by cobalt is 3·5%.

Cobalt and antimony are completely miscible in the liquid state. The compounds CoSb, m. p. 1191°, and $CoSb_2$, which melts with decomposition at 879·5°, are formed. In the solid state, antimony is soluble to the extent of 12·5% in cobalt.

Cobalt and lead are partly miscible in the liquid state; molten alloys containing more than 3% or less than 99% of cobalt cannot be obtained. Neither compounds nor mixed crystals are formed in the solid state.

The behaviour of cobalt and bismuth is similar to that of cobalt and lead, the limits of miscibility in the liquid state being represented respectively by 6% and 93% of cobalt.

Cobalt and thallium are only slightly miscible both in the liquid and solid state, and there is no evidence of the formation of definite compounds.

Cobalt and zinc yield mixed crystals when the percentage of cobalt in the fused mass varies from 0·5 to 18·5. The saturated mixed crystals contain 13·4% cobalt. Evidence has also been obtained of the formation of a compound $CoZn_4$.

Cobalt and chromium are miscible in all proportions both in the liquid and solid state. The minimum temperature at which crystallisation commences is about 1320°, the composition of the fused mass corresponding with 47% chromium. Alloys containing from 30—100% chromium undergo a change of structure at 1226°. The homogeneous mixed crystals which are primarily formed in the cooling process are transformed at this temperature into two different kinds of crystals, which are readily distinguished after electrolytic etching.

Cobalt and silicon are completely miscible in the liquid condition. In the solid state, the miscibility is confined to alloys containing less than 7·5% or more than 91% silicon. Five compounds are formed: Co_2Si, m. p. 1327°; CoSi, m. p. 1393°; $CoSi_2$, m. p. 1277°; $CoSi_3$, m. p. 1307°, and Co_3Si_2, which is formed in the solid state from the compounds Co_2Si and CoSi.

Measurements of the magnetic permeability of the alloys and the temperatures at which the magnetic qualities undergo changes have been made.

The paper concludes with a discussion of the relationships between the metals iron, cobalt, and nickel on the basis of the freezing-point diagrams of their principal alloys. A table is given showing the miscibility in the liquid states and the compounds formed in each case. The data show that in the liquid as well as in the solid state, the miscibility of nickel with other metals is greater than that of cobalt, which in its turn is greater than that of iron. Nickel also yields the greatest number of compounds, and iron the smallest number.

H. M. D.

Cobalt–Tin Alloys. S. F. Schemtschuschny and S. W. Belynsky (*Zeitsch. anorg. Chem.*, 1908, **59**, 364—370. Compare Lewkonja, preceding abstract).—The alloys formed by cobalt and tin have been studied by an investigation of the cooling curves of molten mixtures containing different proportions of the two metals, and an examination of the micro-structure of the solidified products. The freezing-point diagram, constructed from the experimental data, shows the existence of five curves. Two compounds, Co_2Sn and CoSn, are indicated. The former corresponds with a maximum freezing temperature of 1171°, the latter being characterised by a transition point at 927°. Above 515°, CoSn separates out in α-crystals, and below in β-crystals. The curves for the compounds are limited by eutectic points at 229° and 1112°. The eutectic alloy corresponding with 229° contains less than 1 atom % of cobalt, and that corresponding with 1112°, 79·5 atom % of cobalt. The two compounds are much harder than either of the components. The compound Co_2Sn is magnetic; CoSn has no magnetic properties either in the α- or the β-modification.

H. M. D.

Phosphorus Compounds of Nickel. N. Konstantinoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 742—752).—The freezing-point curve of nickel-phosphorus alloys indicates that, when melted together, nickel and phosphorus form the compounds Ni_5P_2 and Ni_2P, the former of which exists in two modifications; the β-form, which is stable at high temperatures, is transformed into the α-form at 1025°. At lower temperatures there exist also the compound Ni_3P, and another, richer in phosphorus than Ni_2P. With Ni_2P, the β-modification of Ni_5P_2 forms solid solutions, the limiting concentration of which corresponds with about 18% of phosphorus by weight (29·5 atomic %). These solid solutions decompose into the α-form of Ni_5P_2 and Ni_2P at 1000°.

T. H. P.

Action of Arsenic Trichloride on Nickel and the Arsenico-nickels. Émile Vigouroux (*Compt. rend.*, 1908, **147**, 426—428).—Powdered reduced nickel, when heated in arsenic chloride vapour, is not attacked below 400°. Between 400° and 600°, it is converted into nickel chloride and a compound having a composition corresponding with NiAs. The same compound is formed at 600° to 800°, but at 800—1400° the product consists of Ni_3As_2.

By heating a mixture of powdered nickel and arsenic in an atmosphere of hydrogen, or by heating the metal in arsenic vapour, a series of arsenico-nickels is readily obtained. These contain, when prepared at 300—400°, 72% of arsenic; at 400—600°, 65% of arsenic; at 600—800°, 56% of arsenic; above 800°, 46% of arsenic, whilst an arsenide containing 39% of arsenic is obtained by treating alloys containing 11—38% with dilute sulphuric acid and separating with a magnet. On heating with arsenic chloride vapour, these arsenico-nickels tend to form NiAs at 400—800° by absorption or loss of arsenic, whilst at 800—1400° the resulting compound is Ni_3As_2.

The arsenide NiAs, identical with the natural nickeline, has a red colour, and, according to the temperature of preparation, is obtained as a powder, composed of small crystals with a metallic lustre, or as a slightly fritted mass, D^0 7·57.

The arsenide Ni_3As_2 (also obtained by Wöhler, *Ann. Chim. Phys.*, 1832, [ii], **51**, 208; by Descamps, Abstr., 1878, 705, and by Granger and Didier, Abstr., 1900, ii, 349) is a grey, pulverulent substance with a metallic lustre, which melts at 1000°, giving a hard, brilliant silver-white ingot, which readily breaks into lamellæ, D^0 7·86.

The arsenide NiAs commences to lose arsenic at 100°, being converted into Ni_3As_2, which is very stable, and is only slightly decomposed at 1400°. Conversely, when heated in an atmosphere of hydrogen at decreasing temperatures in the presence of arsenic, these two compounds absorb the latter, giving, finally, below 400° a grey powder having the composition $NiAs_2$, identical with rammelsbergite.

The arsenides are attacked by heated chlorine, oxygen, or sulphur vapour. They are rapidly dissolved by nitric acid and aqua regia, are very slightly attacked by hydrochloric and sulphuric acids, are decomposed by fused potassium chlorate and nitrate, but are only slowly attacked by alkalis or alkali carbonates. E. H.

Some Alloys of Chromium and Manganese. G. HINDRICHS (*Zeitsch. anorg. Chem.*, 1908, **59**, 414—449).—Aluminothermic chromium and aluminium were used. Chromium is very viscous at its melting point, and requires to be heated more strongly to yield uniform alloys; magnesia crucibles are therefore necessary. When a carbon electric furnace is used, some carbon is always absorbed by the chromium, owing to the passage of gas through the porous magnesia.

The freezing point of chromium (1550°) is lowered by the addition of tin up to 10%, mixed crystals being formed up to 6% Sn. Beyond this, two liquid layers are formed, one of which is practically pure tin.

Chromium and copper are only miscible to a small extent in the liquid state, but the emulsion formed does not separate readily into two layers.

Liquid chromium and silver are also only partly miscible. The addition of 5% Ag lowers the freezing point of chromium by 50°. Solid solutions are not formed.

Molten zinc dissolves chromium to some extent; molten cadmium not at all.

The addition of 27% of lead lowers the freezing point of chromium by 80°; alloys richer in lead separate into two layers, one of which is pure lead.

The preparation of alloys of chromium and aluminium is difficult, owing to oxidation and to the action of aluminium on the magnesia crucible at the high temperature necessary. It is better to prepare them by the ignition of a mixture of aluminium, chromium oxide, and potassium dichromate. Between 5% and 55% Cr, the liquid forms two layers, and there appears to be a compound of the formula Cr_3Al, the melting point of which lies much above 1600°.

Manganese and silver form immiscible liquids from 30% to 90% Mn, and do not form solid solutions.

Manganese and aluminium form two compounds, probably Mn_3Al and $MnAl_3$, both of which form mixed crystals. Alloys containing between 57% and 86% Al separate into two liquid layers.

Tammann's rule (Abstr., 1907, ii, 445) is confirmed, that the element with the higher m. p. takes up more of that with the lower m. p. to form mixed crystals than conversely. C. H. D.

Sodium Chromisilicates. ZYGMUNT WEYBERG (*Centr. Min.*, 1908, 519—523).—By fusing a mixture of silica, sodium carbonate, and chromic oxide with a large excess of sodium chloride, a dark green, crystalline powder having the composition

$$6SiO_2,3Cr_2O_3,2Na_2O$$

was obtained; the crystals are orthorhombic and strongly pleochroic. A mixture of sodium metasilicate, chromic hydroxide, and excess of sodium chloride gave rhombic crystals with the composition

$$11SiO_2,2Cr_2O_3,5Na_2O;$$

and a mixture of ammonium dichromate, sodium metasilicate, and sodium chloride gave the product $95SiO_2,2Cr_2O_3,3Na_2O$ in tridymite-like crystals.

The compounds obtained when chromium takes the place of aluminium or iron in these experiments are thus of quite a different type (Abstr., 1906, ii, 23, 91, 865). When the sodium salts are replaced by salts of other alkali or alkaline earth metals, no definite results were obtained. With lithium salts, olivine-like crystals of lithium ortho-silicate, Li_4SiO_4, were formed. L. J. S.

Treatment of Pitchblende Residue. LUDWIG HAITINGER and KARL ULRICH (*Monatsh.*, 1908, **29**, 485—496).—The paper deals with the working up of the radioactive residue (10,000 kilograms) from 30,000 kilograms of pitchblende containing 53·4% U_3O_8. The operations, which occupied two years, are the following: The residue is heated for a working day with half its weight of sodium hydroxide (25% solution). After washing away the greater part of the soluble sulphates, the residue is digested on the water-bath with one and a-half times its weight of hydrochloric acid (1 : 1), and then washed with water. The hydrochloric acid extract is practically free from radium, but contains the bismuth-polonium and the actinium. The residue is next heated with half its weight of sodium carbonate (25% solution, free from sulphate), whereby a great part of the radium sulphate is converted into the carbonate; the mass is washed until free from soluble sulphates, and treated with pure hydrochloric acid. After three such treatments with sodium carbonate, &c., the final residue is practically free from radium, as also are the sodium carbonate extracts and the aqueous washings. The hydrochloric acid extracts, containing all the radium, are treated with sulphuric acid; the precipitated sulphates of lead, metals of the alkaline earths, and of the rare earths in the form of double sulphates, are heated repeatedly with an excess of concentrated sodium carbonate. The conversion of the sulphates into the carbonates is never complete, and therefore, after extracting the mass with hydrochloric acid, the residue is boiled with water to remove the lead chloride (which is purified by recrystallisation and utilised for the preparation of radioactive lead) and then added to the next batch of crude sulphates. The hydrochloric acid solution, containing the radium, is freed from lead by hydrogen sulphide, evaporated to dryness, and the greater part of the calcium chloride extracted by concentrated hydrochloric acid. The resulting crude chloride, containing radium and barium, and also strontium, calcium, and small amounts of other substances, weighs 20 kilograms in a moist state; the least soluble constituent is the radium chloride. By repeated fractionation, it is separated into two parts, one (2 kilograms) containing nearly all the radium, and the other (11 kilograms) containing very little. The smaller part is again fractionated until the first crop of crystals is reduced to 9 grams. This crop is dissolved, freed from a little impurity by hydrogen sulphide, and separated in silica vessels into four subsidiary fractions and one "final" fraction, on which a determination of the atomic weight, by Richard's method for barium, gave the value 225, whilst the activity number was $27{\cdot}2 \times 10^6$. The activity numbers of the four subsidiary fractions are $17{\cdot}0 \times 10^6$, $6{\cdot}1 \times 10^6$, $2{\cdot}5 \times 10^6$, and $3{\cdot}1 \times 10^6$ respectively. The total calculated amount of radium corresponds with 3·236 grams of anhydrous radium chloride of activity $27{\cdot}2 \times 10^6$.

A portion of the crude barium was converted into the bromide, from which a "final" fraction of radium bromide was obtained. It weighed 0·5 gram, and after a year the weight had decreased to 0·389 gram. It was examined by Brill, who found that it lost 5·4% in weight when heated, gained 17·2% when heated in a current of hydrogen bromide, and contained 0·1792 gram of radium. The fact that radium bromide loses bromine by keeping is not generally known. C. S.

Physicochemical Researches on Tin. VII. ERNST COHEN (*Zeitsch physikal. Chem.*, 1908, **63**, 625—634. Compare Abstr., 1900, ii, 83, 212, 408; 1901, ii, 106, 244; 1904, ii, 567; 1905, ii, 168).—Since the publication of the author's earlier papers, numerous cases of the corrosion of coins, organ-pipes, and other articles made of tin, due to partial conversion into the grey modification, have come to light. Photographs of a number of these articles are reproduced.

A large quantity of grey tin having been put at the disposal of the author, the transition temperature has been determined with greater accuracy than heretofore. It is found to lie very close to 18°.

J. C. P.

An Alloy of Thorium and Nickel. ÉDOUARD CHAUVENET (*Bull. Acad. roy. Belg.*, 1908, 684—685).—Moissan and Hönigschmidt (Abstr., 1906, ii, 678), attempting to prepare metallic thorium by reducing potassium thorium chloride or thorium chloride with metallic sodium, obtained a metal containing 10—25% of thoria. The author, using lithium instead of sodium, and heating in a nickel boat, failed to prepare pure thorium, but obtained an alloy of thorium and nickel in the form of either grey lamellæ or a black pyrophoric powder. The analysis of this agrees with the formula Th_2Ni. The alloy invariably contains 10% of thorium oxide. The pyrophoric variety inflames spontaneously either when powdered in a mortar or when dried in an oven at 115°. It does not give nickel carbonyl when heated in carbon monoxide at 60°, whilst at 400° the gas is decomposed with depositions of carbon. The alloy is non-magnetic, and is rapidly dissolved by hydrochloric acid. E. H.

Rapid Preparation of Antimony Pentasulphide (Golden Sulphide). Albert Sartorius (*Chem. Zentr.*, 1908, i, 2130—2131; from *Apoth. Zeit.*, 1908, **23**, 342—343).—The usual method of preparing Schlippe's salt is to boil antimony trisulphide and sulphur with sodium hydroxide one and a-half to two hours, when, theoretically, sodium sulphantimonate and sodium meta-antimonate should be formed, If, however, the process is stopped after one-quarter of an hour's boiling. it is found that scarcely any of the antimony trisulphide has been acted on, the reaction that takes place being expressed by $6NaOH + 4S = 2Na_2S + Na_2S_2O_3 + 3H_2O$. To avoid this formation of thiosulphate, the author adds the mixture of antimony trisulphide and sulphur to the boiling sodium hydroxide solution, in small portions at a time. Under these conditions, the reaction proceeds according to the following equation: $4(Sb_2S_3 + 2S) + 18NaOH = 5Na_3SbS_4 + 3NaSbO_3 + 9H_2O$, and in a shorter time a larger yield of Schlippe salt of a better quality is obtained. J. V. E.

Thioantimonates of Alkali Metals. II. A. D. Donk (*Chem. Weekblad*, 1908, **5**, 629—645. Compare Donk, this vol., ii, 763).—From mixtures of the corresponding alkali thioantimonates with methyl alcohol and water, the following hydrated salts have been isolated: $Na_3SbS_4,9H_2O$ (at 0° and 30°) and $K_3SbS_4,9H_2O$ (at 15°). Similar mixtures of alkali thioantimonates with the corresponding hydroxides and water yielded the following hydrated salts:

$Na_3SbS_4,9H_2O$;
$Na_3SbS_4,9H_2O + NaOH,H_2O$; $NaOH,H_2O$ (at 30°); $K_3SbS_4,5H_2O$; $K_3SbS_4,3H_2O$; K_3SbS_4; $K_3SbS_4 + KOH,H_2O$; KOH,H_2O (at 30°); $(NH_4)_3SbS_4.4H_2O$ (at 30°); $LiOH,H_2O$; $Li_3SbS_4,10H_2O + LiOH,H_2O$; $Li_3SbS_4,10H_2O$ (at 30°). A. J. W.

Dissolution of Metallic Gold in Hydrochloric Acid in Presence of Various Organic Substances. N. D. Averkieff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 840—859).—Metallic gold dissolves in hydrochloric acid in presence of the following compounds, which are arranged in decreasing order of effectiveness: methyl alcohol, amyl alcohol, chloroform, ethyl alcohol, chloral hydrate, phenol, sucrose, glycerol, trioxymethylene, formaldehyde. The dissolution takes place slowly at the ordinary temperature, but much more rapidly on heating, the time of heating having but little effect on the rate of solution. In some cases it was found that the solution of the gold was accelerated by increasing the amounts of acid and organic substance.

The residues obtained by evaporating these solutions on a water-bath give metallic gold on ignition, the loss on ignition differing from that observed with $AuCl_3,2H_2O$ (loss, 51·6%). Thus, with chloroform, this loss is 45·63; with methyl alcohol, 60·3; with phenol, 65·08; with ethyl alcohol, 78·0; with trioxymethylene, 85·1, and with amyl alcohol, 85·01%.

The results obtained indicate the existence of new compounds and reactions of gold, which are being further studied. T. H. P.

Complex Gold Sulphites. ARTHUR ROSENHEIM, JULIAN HERTZMANN, and MAX PRITZE (*Zeitsch. anorg. Chem.*, 1908, **59**, 198—202).—Two complex sulphites of tervalent gold, $K_5[Au(SO_3)_4],5H_2O$ and $Na_5[Au(SO_3)_4],14H_2O$, were obtained in slender, deep yellow needles by the action of the corresponding alkali hydrogen sulphites on a solution of auric chloride in just sufficient alkali to form a clear solution. The compounds are stable in cold alkaline solution, but soon decompose in neutral or acid solution. On heating, the yellow alkaline solutions become colourless, and probably contain univalent gold, but no definite compounds could be isolated.

When a concentrated solution of gold chloride is added drop by drop to a solution of ammonium sulphite containing excess of ammonia, and the solution is gently warmed, it becomes colourless, and the *compound*, $Au_3(SO_3)_2,4NH_3,4H_2O$, separates in colourless, lustrous leaflets. Similarly, from a solution of potassium sulphite to which excess of ammonia has been added, the compound

$$Au(SO_3)_3K_3,2NH_3,2H_2O$$

is obtained in colourless needles. The constitution of these two compounds has not been established. G. S.

Nature of Palladium-Lead Alloys. NICOLAI A. PUSHIN and N. P. PASHSKY (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 826—829).—The authors have prepared a number of alloys of palladium and lead by melting the metals in a mixture of lithium chloride with either potassium chloride or barium chloride. The potentials of the various alloys were measured by means of a Pb | *N*-$Pb(NO_3)_2$ | alloy element (compare Pushin, Abstr., 1907, ii, 325). All the alloys containing less than 33% (atom.) of palladium have a potential practically identical with that of pure lead, whilst those containing more than 33% (atom.) of palladium give with pure lead a P.D. of more than 600 millivolts. Alloys of the latter class give at first a P.D. of 350—400 millivolts, which, however, increases rapidly at the commencement and more slowly later, approaching asymptotically the value 605—640 millivolts, which value persists for eight to ten hours. The potential of pure palladium also changes in the course of time, the element

$$Pb \mid N\text{-}Pb(NO_3)_2 \mid Pd$$

having at first a P.D. of 760 millivolts; after two hours, the value 880 millivolts is reached, and after a further three hours, this begins to diminish slowly until 600 millivolts is reached. The above results prove clearly the existence of the compound Pb_2Pd. T. H. P.

Mineralogical Chemistry.

Native Tellurium from Asia Minor. GIUSEPPE CESÀRO (*Bull. Acad. roy. Belg.*, 1908, 255—257).—Amongst a series of specimens from the mines of Balia was a large (2 × 3 cm.) dendritic crystal of native tellurium intergrown with quartz. A small proportion of gold is the only impurity present in the material. L. J. S.

Action of Potassium Chlorate on Pyrites and on Hauerite. GIORGIO SPEZIA (*Atti. R. Accad. Sci. Torino*, 1908, 43, 728—734).—A mixture of pyrites with sufficient potassium chlorate to oxidise between 1 and 2 atoms of the sulphur of the pyrites explodes when brought into contact with either concentrated sulphuric acid or a flame. Under similar conditions, a mixture of sulphur or stibnite with potassium chlorate undergoes rapid combustion, approaching to explosion. With less or more than the above proportion of chlorate, pyrites gives a mixture which does not explode, but undergoes more or less rapid combustion.

The reaction between pyrites and potassium chlorate in the wet way differs, however, greatly from that between sulphur or stibnite and potassium chlorate. When the former mixture, either in explosive proportions or containing an excess of the chlorate, is heated with water, a vigorous reaction begins at 75° and continues without further heating; a yellow deposit forms, chlorine is evolved, and sulphuric acid is detectable in large proportion in the solution. A reaction also takes place very gradually in the cold, but in this case no evolution of chlorine is observed. With potassium chlorate and sulphur or stibnite, no such reaction occurs, and only after protracted heating at 100° is a trace of sulphuric acid formed.

Marcassite behaves with potassium chlorate, in both the wet and dry ways, in the same manner as pyrites, the vigorous reaction in the presence of water commencing at 70°. Hauerite forms an explosive mixture with potassium chlorate, but does not react with it in the presence of water, even at 100°.

When heated, hauerite begins to lose sulphur at about 170°, and is ultimately converted into manganese monosulphide; pyrites, on the other hand, loses sulphur only at about 350°, and gives a compound corresponding with pyrrhotite as final product, the monosulphide only being obtained from pyrites by heating in a current of hydrogen.

From these results, the author concludes that the sulphur present in combination with iron in pyrites has properties different from those of elementary sulphur. T. H. P.

Natural Ferrous Oxide Hydrate. HART (*Chem. Zeit.*, 1908, 32, 746).—In the clay deposit near Cuxhaven, hard, yellowish-brown lumps have been found among volcanic ash, which crumble when exposed to the air and appear to be ferrous oxide dihydrate, $FeO,2H_2O$.

Analysis showed 12·55% to be insoluble in hydrochloric acid; the soluble portion had the following composition:

FeO.	Fe_2O_3.	$CaCO_3$.	$MgCO_3$.	SO_3.	Water.	Total.
43·68	0·42	4·5	8·52	0·75	27·71	98·13

The powdered substance had $D^{17\cdot5}$ 3·205. J. V. E.

Origin of the Boric Acid in the Soffioni of Tuscany. RAFFAELO NASINI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 43—46).—In a paper read before the Sixth International Congress of Applied Chemistry in Rome (1906) on "The Boraciferous Soffioni and the Boric Acid Industry of Tuscany," the author referred to a theory put forward by E. Perrone to explain the formation of these soffioni. This theory regards tourmaline as the source of the boric acid. The original temperature of the vapours of the soffioni cannot be less than 250°, and the depth from which they come must be from 5000 to 8000 metres. At this depth there probably exist granitic rocks containing tourmaline, having the characters of the granite found in Elba and elsewhere. The author's experiments show that when steam at a high temperature is passed over tourmaline extracted from Elba granite and subsequently condensed, the condensed liquid contains boric acid. As, further, this granite exhibits radioactivity, the presence of radioactive gases in the soffioni gases is readily explained.

Objections to this theory raised by D'Achiardi (*Atti Soc. toscana sci. nat. Mem.*, 1907, **23**) and Lotti (*Rassegna mineraria dell'indust. chim.*, 1907, **26**, No. 14) are discussed. T. H. P.

The Wide Distribution of Scandium in the Earth. G. EBERHARD (*Sitzungsber. K. Akad. Wiss. Berlin*, 1908, 851—868).—Although scandium appears to be relatively abundant in the sun and stars, yet it has only rarely been detected in terrestrial materials. Three hundred and sixty-six samples of minerals, rocks, and meteorites of various kinds were examined spectroscopically, and traces of scandium found in a large number of them. It occurs most frequently in zirconium minerals, beryl, titanates, columbates, and titano-columbates of the rare earths, in micas, and in tin and tungsten ores. Wolframite from Zinnwald, Bohemia, contains 0·2% of scandium oxide (Sc_2O_3).

L. J. S.

Composition of Parisite and Malacon. G. P. TSCHERNIK (*Chem. Zentr.*, 1908, ii, 192; from *Verh. Russ. Min. Ges.*, 1907, **44**, 507—545).—The minerals analysed are from a weathered graphic granite from the neighbourhood of Mukden. The prismatic crystals of parisite are of two kinds: I, dark grey and transparent, D 4·396, H 5—6; II, yellowish-grey and opaque, D 4·331, H 4—5:

	Ce_2O_3.	La_2O_3.	Y_2O_3.	Fe_2O_3.	CaO.	Na_2O.	CO_2.	H_2O.	F.
I.	21·88	33·11	7·86	0·28	3·78	2·28	23·69	2·45	6·37
II.	21·81	32·62	8·76	—	3·69	2·15	22·94	2·93	6·16

The dark grey opaque grains of malacon, with D 4·016 and H over 7, gave the results under III:

	SiO_2.	SnO_2.	ZrO_2.	Fe_2O_3.	MnO.	Y_2O_3.	CaO.	H_2O.
III.	29·67	0·10	49·04	3·43	0·03	4·55	2·99	9·07

L. J. S.

Existence of a Monoclinic Soda Felspar, Isomorphous with Orthoclase. PHILIPPE BARBIER and A. PROST (*Bull. Soc. chim.*, 1908, [iv], 3, 894—899. Compare this vol., ii, 704).—Analyses of seven samples of orthoclase, briefly described in the original, show that orthoclases exist having the potassium partly or wholly replaced by sodium, the latter occurring as a special silicate (not identical with albite) which can ally itself with the orthoclase molecule without causing a change in crystalline form. If orthoclase is represented by the expression $K_2Al_2Si_6O_{16}$, the sodium compound must be represented as $Na_2Al_2Si_6O_{16}$. T. A. H.

Kaersutite from Linosa and Greenland. HENRY S. WASHINGTON and FRED. EUGENE WRIGHT (*Amer. J. Sci.*, 1908, [iv], 26, 187—211).—Crystals of a black basaltic amphibole were collected from the tuff of a small parasitic cone of Monte Rosso, on the small island of Linosa off the coast of Tunis. They are monoclinic, with a prism cleavage angle of 55°22′. Thin sections are brown and strongly pleochroic; the extinction angle is small and in the acute angle β (on the prism plane $c' : \mathfrak{c} = +1{\cdot}4^\circ$); the optic axial plane lies in the plane of symmetry, and $2V$ is about 80°. Analysis I shows the mineral to be highly titaniferous, and to be very similar to the kaersutite (of Lorenzen, 1884) from Kaersut, in Greenland. A re-examination and a new analysis (II: 0·77% apatite deducted) were made of the original kaersutite:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	NiO.	MgO.
I.	40·85	8·47	9·89	8·85	3·96	0·12	0·10	12·47
II.	39·52	10·31	11·22	1·22	8·81	0·06	nil	13·31

	CaO.	Na_2O.	K_2O.	H_2O.	F.	Total.	Sp. gr.
I.	12·16	2·01	0·63	0·19	0·28	99·98	3·336
II.	10·93	2·95	1·07	0·59	—	100·00	3·137

The presence together of large amounts of titanium and iron oxides (Fe_2O_3 and TiO_2 or FeO and Ti_2O_3) gives rise to uncertainties in the analyses and in the interpretation of the results; the results can, however, be made to conform with the meta-silicate formula of Penfield and Stanley (Abstr., 1907, ii, 102). L. J. S.

Mineralogy of Sardinia. II. A. PELLOUX (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 70—74. Compare *Atti R. Accad. Lincei*, 1904, [v], 13, ii).—The author describes crystals of idocrase found (1) in the Baccu Arrodas Mines in Sarrabus, and (2) in the Rio Planu Castangias Mines in Iglesiente.

[CARLO RIMATORI.]—The composition of the crystals from Rio Planu Castangias is as follows:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	Total.	D^{22}.
39·17	11·35	13·39	33·31	trace	trace	3·74	100·96	3·358

T. H. P.

Taramellite, a New Silicate of Iron and Barium. E. TACCONI (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 810—814; *Centr. Min.*, 1908, 506—508).—The author describes a new mineral, *taramellite*, occurring in radiating, fibrous, acicular aggregates or slender veins in the crystalline, calcareous zone of Candoglia-Ornavasso (Val Toce), where it is found in intimate association with magnetite, pyrites, chalcopyrite, paracelsian, pyroxene, and amphibole. It has a reddish-brown colour, a silky or fatty lustre, a hardness of about 5·5, D^{17} 3·923, n greater than 1·74. The mineral exhibits distinct pleochroism, and has the composition :

SiO_2.	Fe_2O_3.	FeO.	BaO.
36·56	21·54	4·47	37·32

together with traces of titanium, aluminium, manganese, and magnesium. The above composition leads to the formula

$$Ba_4Fe^{II}Fe_4^{III}Si_{10}O_{31},$$

and the mineral may be regarded as a basic salt of a polymeride of metasilicic acid, $Ba_4Fe^{II}(Fe^{III}O)Fe_3(SiO_3)_{10}$. T. H. P.

The Zeolites of Montresta (Sardinia). Luciano Pelacani (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 66—70).—The zeolites of Montresta include mesolite (anal. I), chabazite (anal. II), heulandite, and stilbite, the first occurring in greatest, and the last in smallest, proportion :

	SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	42·94	25·05	10·87	8·12	trace	13·32	100·30
II.	46·30	21·96	7·78	—	2·27	21·37	99·68

The analyses agree with those of Rimatori (Abstr., 1900, ii, 735). Mesolite is regarded as an isomorphous mixture of scolecite and natrolite, and, from a study of the emission of water on heating, the mesolite of Montresta seems to be more closely allied to scolecite than to natrolite. The amount of water emitted by chabazite when gradually heated to 350° increases more slowly than the temperature rises, whilst with mesolite the reverse is the case. The re-absorption of the water removed by heating to 350° takes place rapidly and completely with chabazite, whilst with mesolite it is slow and only partial. After heating to redness, chabazite absorbs about one-fourth of the total water emitted, whilst mesolite absorbs none at all.

The heulandite has the composition :

SiO_2.	Al_2O_3.	CaO.	SrO & BaO.	Na_2O.	K_2O.	H_2O.	Total.
57·59	15·69	7·62	traces	2·87	trace	15·77	99·54

which approximates to that of the heulandite from Berufiord, analysed by Rammelsberg (*Zeitsch. deut. geol. Ges.*, 1869, **21**, 93). The stilbite was found only in small quantity, insufficient for analysis. T. H. P.

New Vein of Nephelitic Basalt containing Nosite (Nosean) in Vincentino. L. Maddalena (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 802—809).—The author has discovered in Vincentino a nephelitic basalt of microporphyritic structure, containing pyroxene, biotite, apatite, magnetite, and nosite, the last being scattered irregularly in crystals and granules, mostly of hexagonal habit. The basalt has the composition:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.
31·39	12·15	5·89	6·41	0·41	16·61	9·82	3·48	1·21

P_2O_5.	TiO_2.	CO_2.	H_2O at 110°.	H_2O at red heat.	Total.
1·40	1·23	5·31	1·66	3·17	100·14

which approximates to that of the basalt of Recoaro, the lower proportion of silica in the Vincentino basalt being due to the more advanced condition of alteration of the rock. T. H. P.

Physiological Chemistry.

Regulation of Respiration. F. H. SCOTT (*J. Physiol.*, 1908, **37**, 301—326).—The respiratory mechanism may be stimulated by small amounts of carbon dioxide, or by great diminution of oxygen in the inspired air. These produce increase of both rate and depth of breathing, but if the vagi are divided, the depth increases but not the rate. The alveolar tension of carbon dioxide rises with rise of body temperature; the effect of vagal division on the tension is very variable. Inflation of the lungs even at the height of dyspnœa inhibits inspiration, but if the vagi are divided, it has no effect. The effect of repeated ventilations depends on the washing-out of carbon dioxide from the blood (confirmatory of Haldane). The vagi in reference to respiration are regarded in the same light as the sensory nerves of muscle; without these nerves muscular movements are excessive, and thus resemble those of an ataxic limb. W. D. H.

Heart Perfusion Apparatus. THOMAS G. BRODIE and WINIFRED C. CULLIS (*J. Physiol.*, 1908, **37**, 337—340).—A new apparatus for the perfusion of the isolated mammalian heart is described and figured. W. D. H.

Hæmagglutination and Hæmolysis. LEO VON LIEBERMANN (*Centr. Bakt. Par.*, 1908, **47**, ii, 372—378).—Polemical and theoretical. Von Eisler (*Centr. Bakt. Par.*, 1908, **46**, 353) has attributed to the author the view, that agglutination by ricin is due to the acid nature of this substance, pure and simple. This is a misunderstanding; ricin appears, indeed, to be an acid, but its agglutinant action is a specific property, not shared by other acids, and due to the peculiar physical properties of the ricin-stroma combination (compare Abstr., 1907, ii, 973). In connexion with this, Landsteiner's views are discussed. The inhibitory action of alkali primarily extends to the complement, but also affects the immune substance. G. B.

The Time Relations of Hæmolysis on Exposure to Light of Sensitised Red Blood-corpuscles. O. HARZBECKER and ALB. JODLBAUER (*Biochem. Zeitsch.*, 1908, **12**, 306—313).—Suspensions of red blood-corpuscles were submitted to the action of the sensitising substances eosin and sodium dichloroanthracenedisulphonate in the dark, and then exposed to light. The amount of hæmolysis was ascertained by measuring the volume of blood-corpuscles, and of hæmoglobin in the supernatant liquid, in samples of liquid centrifuged after different intervals of exposure to light. It was found in all cases that hæmolysis was a gradual process, and took place at the same rate whether the fluorescing substance was within or both within and without the cell. S. B. S.

Hæmolysis by Snake Poison. VON DUNGERN and COCA (*Biochem. Zeitsch.*, 1908, **12**, 407—421).—The hæmolytic action of cobra poison depends entirely on the existence of a lipolytic enzyme, by means of which hæmolytically-acting scission products, especially deoleolecithin and oleic acid, are produced. Compounds of lecithin and cobra toxin do not exist; there are no such substances as either saturated or unsaturated toxolecithides. The preparations of Kyes (Abstr., 1907, ii, 569) are mixtures of ferment with deoleolecithin, contaminated with other substances, or their scission products, which are found in commercial lecithin. Cobra poison contains no amboceptors, and the hæmolysis produced by a combination of cobra poison and complement containing serum is due to a complex serum hæmolysin, which acts hæmolytically only under certain conditions, and only when the blood-corpuscles have taken up a certain quantity of lipase. S. B. S.

Hæmolysis by Soaps, and the Relationship between Soaps and the Complex Hæmolysins of the Blood-serum. MAX FRIEDMANN and FRITZ SACHS (*Biochem. Zeitsch.*, 1908, **12**, 259—277).—Noguchi and von Liebermann have shown that soap can be deprived of its hæmolytic properties by admixture with serum, and have expressed the view that this inactivated mixture acts as a complement, the hæmolytic powers of which can be called into play by the addition of an amboceptor. Such an amboceptor, von Liebermann claims to have discovered in oleic acid, The authors have devised experiments to test the above hypotheses. They have confirmed the fact of the combination between serum and the soap, which is rendered more stable by heating to 70°. They have, however, been unable to confirm the hypotheses as to the complement nature of this combination, or of the amboceptor-nature of oleic acid. The activation of the amboceptor by the addition of the soap-serum mixture, they ascribed to the action of a true serum complement contained in the sera, which had not been entirely destroyed by heating to 50°. The supposed amboceptor action of oleic acid they ascribed to the additive action of the acid and of the soap-serum mixture, each of which was, by itself, unable to produce hæmolysis. S. B. S.

Hæmolysis by Soaps. FRITZ SACHS (*Biochem. Zeitsch.*, 1908, **12**, 278—289).—Although soaps can be deprived of their hæmolytic power by previous admixture with serum, the latter can accelerate their action if the soaps be added first to the suspension of corpuscles. Serum can also accelerate in a like manner, the hæmolytic action of oleic acid, which fact, amongst others, led von Liebermann to ascribe amboceptor functions to this acid. The author has attempted to determine the nature of the substance in serum which accelerates hæmolysis by soaps. Serum-albumin is inactive; alkalis markedly accelerate the action. It is not to the alkali, however, that serum owes the accelerating property, for neutralised or dialysed serum still possesses it; furthermore, serum which has been deprived of its proteins loses this property. Serum which has been extracted with ether, gains in the hæmolysis-accelerating power. The experiments with alkali render it probable that the concentration of hydroxyl ions influences the hæmolysis, and the extraction of serum by ether, in removing the fatty acids from the soaps contained therein, may increase the alkalinity of the serum. The experiments, however, lead to no definite conclusions as to the nature of the hæmolysis-accelerating substances in serum.

S. B. S.

The Point of Attack of Photodynamic Substances in Paramœcia. Hermann von Tappeiner [with F. Osthelder and E. Erhardt] (*Biochem. Zeitsch.*, 1908, 12, 290—305).—*Paramoecia*, which have been treated with eosin in the dark, are no more strongly sensitised than those which have been exposed immediately to the light. The eosin does not appear to possess the property of penetrating the cell; its action in sensitising is entirely at the periphery. Dichloroanthracenedisulphonic acid and methylene-blue, on the other hand, are taken up in active form by the cell in the dark; their point of attack is intracellular; there is evidence, however, in the case of these two substances of a peripheral, in addition to the intracellular, action. As to the nature of the peripheral action, nothing definite can be stated.

S. B. S.

Action of Fluorescent Substances on Red Corpuscles. Hermann von Tappeiner (*Biochem. Zeitsch.*, 1908, 13, 1—23).—Eosin and sodium dichloroanthracenedisulphonate produce in the dark at the room temperature no noteworthy destruction of red corpuscles, and, after removal from the solution, they undergo hæmolysis at 59° at the same rate as untreated corpuscles. In the light, however, rapid hæmolysis occurs. These substances are therefore taken up by the corpuscles in a form in which they are not sensibilised. This hæmolysis is more rapid if the light acts before than after washing of the corpuscles from the fluorescent solution. Whether the action occurs in the interior or on the surface of the corpuscles is discussed; phenosafranine shows both kinds of action; methylene-blue only a surface action.

W. D. H.

Action in the Dark of Fluorescent Substances on Proteins, Toxins, and Ferments, and its Reversibility. T. Kudo and Alb. Jodlbauer *Biochem. Zeitsch.*, 1908, 13, 24—43).—Many fluorescent substances act in the dark on the alexin of serum and on tetanolysin, inhibiting their specific actions. This is not the case with all fluorescent substances, and the concentration necessary to produce the effect in the dark is relatively high in comparison with that of those which act photodynamically. Those which act in the dark are considered to be adsorbed, and the action is reversible; the presence of alkali is favourable, whilst that of invertase, inhibits. W. D. H.

Nucleoli of Hydra fusca. C. E. Walker and Alice L. Embleton (*Quart J. Exp. Physiol.*, 1908, 1, 287—290).—The observations relate to the movements of the nucleoli of the cells of the hydra from the nucleus into the surrounding cell protoplasm. The phenomenon is not related to cell division, but is connected with or dependent on metabolic changes, especially with digestion, since it is seen principally in endoderm cells. A marked change takes place in the staining reactions of the extruded nucleolus, which suggests that it undergoes an important chemical or physical change. W. D. H.

The Death of Leucocytes. The Vacuolation of Leucocytes. H. C. Ross (*J. Physiol.*, 1908, **37**, 327—332, 333—336).—Methylene-blue kills cells; it is not until death occurs that the nucleus is stained; this is hastened by heat and alkalis, and delayed by neutral salts. After death, the cytoplasm liquefies, and the granules show Brownian movements; this may be brought about by the absorption of fluid. During life the cytoplasm is a jelly.

Certain spots in leucocytes described by previous observers as centrosomes are droplets of fluid absorbed by the cells, which are suspended in the jelly-like cytoplasm. With the liquefaction of the latter which occurs on death, these droplets disappear. W. D. H.

The Production in vivo and in vitro of Precipitins for Ovalbumin by means of Antigens of a Chemically definite Nature. André Mayer and Georges Schæffer (*Compt. rend.*, 1908, **147**, 311—313).—The precipitating serum for egg-albumin, usually produced from the rabbits by repeated injection of egg-albumin into the animal, can also be obtained if the animal is starved for five or six days, and the serum collected when it has lost about one-third of its weight and the urine is markedly acid. The precipitating property also appears after chloroform intoxication, and after the formation of aseptic peritoneal abscesses by turpentine. In every case the serum loses its precipitating property after warming to 60°. It was assumed that precipitating sera were produced by the presence therein of products of tissue degradation. Amongst such products are the fatty acids, and attempts were made to produce precipitating sera by injection of these acids. It was found that the sera of animals which had received repeated injections of propionic, butyric, valeric, hexoic, and oleic acids produced marked precipitins with solutions of egg-white. No precipitants were produced by the injections of octoic, stearic, palmitic, hydrochloric, lactic, or succinic acids.

The precipitate produced is specific for egg-albumin, and the precipitate is soluble in excess of either of the reacting substances; the serum also loses its precipitating properties on warming to 60°.

Soaps and ethyl esters on injection also produce precipitating sera, but the action is not so marked as in the case of the free acids.

Precipitating sera have also been obtained by adding directly to sera (without injection into animals) fatty acids, soaps, and ethyl esters. In the first case, which yields the most marked results, the precipitating property is only destroyed with difficulty by heating.

S. B. S.

Chemico-physical Studies of Animal Fluids. I*a*. Viscosity of Blood-serum of Different Marine and Terrestrial Animals. Filippo Bottazzi (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 707—717).—Measurements are given of the time of outflow of the blood-serum of different animals from an Ostwald viscosimeter, compared with the values obtained with distilled and sea-water at the same temperatures.

W. A. D.

Chemico-physical Investigations on Animal Liquids. I*b*. Viscosity of the Blood-sera of Certain Marine and Terrestrial Animals. Filippo Bottazzi (*Atti R. Accad. Lincei*, 1908, [v], 17, i, 792—802. Compare preceding abstract).—The classification of marine and terrestrial animals according to the increasing time of efflux of their blood or body-fluid from a viscosimeter does not correspond with the ordinary zoological classification, so that the viscosity of the blood-plasma is not strictly dependent on the degree of organisation of the animal. The viscosity of the body-fluid of the marine invertebrates is only slightly greater than that of sea-water. The blood of cephalopods is distinguished from that of all other animals, vertebrate and invertebrate, by having the greatest viscosity. The viscosity of blood-serum increases with the proportion of colloids (sero-proteins) present.

T. H. P.

Chemico-physical Investigations on Animal Liquids. II. Content of Protein Nitrogen in the Blood-sera of Various Animals. Filippo Bottazzi (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 16—26. Compare preceding abstracts).—The author has determined the proportions of nitrogen, precipitable by tannic acid, present in the blood-sera of various animals. The results show that, in this respect, marine and terrestrial animals are divided into four groups : (1) Those having sera or body-fluids containing less than 0·5% of protein nitrogen; this class includes *Siphunculi*, *Aplysia*, and probably, also, other low marine invertebrates. (2) Various vertebrates and invertebrates, including decapod crustaceans, birds, frogs, and the *Selachii*, with content of protein nitrogen varying from 0·52 to 0·67%. (3) Those with 0·8 to 0·9% of protein nitrogen, namely, herbivorous and carnivorous domestic mammals, such as cats, dogs, rabbits, and oxen. (4) Cephalopods, the serum of which contains, on an average, 1·66% of protein nitrogen. For the buffalo, the % of protein nitrogen is 1·3636, and for the pig, 1·230.

On comparing the numbers obtained with the viscosity results (see preceding abstract), it is found that, in general, the content of protein in the liquids examined increases with the viscosity. It is hence concluded that the greater or less viscosity of the blood-plasma is due to the greater or less proportion of proteins present. This result is confirmed by experiments, in which the concentration of proteins in serum is increased artificially. T. H. P.

Chemico-physical Investigations on Animal Liquids. III. Variations of Electrical Conductivity, Viscosity, and Surface Tension of Blood-serum during Dialysis. Filippo Bottazzi, G. Buglia, and A. Jappelli (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 49—57. Compare preceding abstracts).—The electrical conductivity and surface tension of blood-serum diminish considerably during dialysis, the diminution being at first rapid and afterwards slow; the same is the case when the serum is filtered before the conductivity or surface tension is measured. The viscosity of the serum diminishes if the liquid is filtered before determining the time of efflux; here, too, a slight increase in the time of efflux is observable at the beginning of the dialysis. The diminution of the conductivity is evidently due to the diffusion of the electrolytes, and this also causes the precipitation of the sero-globulin. T. H. P.

Action of Manganese and Iron Sulphates on Diastatic Ferments. Alfred Gigon and T. Rosenberg (*Chem. Zentr.*, 1908, ii, 84; from *Skand. Arch. Physiol.*, 1908, **20**, 423—431).—A 1—2% solution of starch and a small quantity of manganese or iron sulphate were added to a freshly-prepared blood-serum, and the amount of sugar estimated by the polarimeter. The presence of these salts undoubtedly increases the amylolytic action of the blood-serum diastase, and is also favourable to the amylolytic ferment of the pancreatic juice.

J. V. E.

Chemistry of Digestion in Animals. XVII. Digestion and Absorption of Proteins Rich in Bases. E. S. London (*Zeitsch. physiol. Chem.*, 1908, **56**, 378—383). **XVIII. The Importance of the Mouth in Gastric Digestion.** E. S. London and J. D. Pewsner (*ibid.*, 384—387). **XIX. Digestion and Absorption of Meat in the Intestine.** E. S. London and Th. Sulima (*ibid.*, 388—393). **XX. Laws of Digestion and Absorption in the Alimentary Tract.** E. S. London and F. Sandberg (*ibid.*, 394—403). **XXI. Further Investigations of the Same Laws.** E. S. London (*ibid.*, 404—407). **XXII. The Importance of the Blood in Gastric Digestion.** N. A. Dobrowolskaja (*ibid.*, 408—416). **XXIII. Digestion and Absorption of Carbohydrates.** E. S. London and W. W. Polowzowa (*ibid.*, 512—544). **XXIV. Fat-splitting in the Alimentary Canal.** E. S. London and M. A. Wersilowa (*ibid.*, 545—550). **XXV. Composition, Digestion, and Absorption of Tubercle Bacilli.** E. S. London and E. Riwkind (*ibid.*, 551—553. Compare this vol., ii, 50).—The experiments were made on the dogs described in previous publications.

XVII.—If proteins, such as gelatin or histone (from the thymus), which are rich in bases are given, the products of digestion in the jejunum and ileum contain only small amounts of free arginine. The chief substances obtained in the material issuing from the fistula are complexes which are precipitable by tannin. Absorption of gelatin occurs chiefly in the lower parts of the small intestine, and at the end of that tube it is fairly complete.

XVIII.—Details are given of the rate with which the stomach empties itself in dogs; this probably runs *pari passu* with the rate of digestion. Outside psychical influences do not affect this, but if the food is given by the mouth, it is much accelerated, probably because the normal reflexes due to taste impulses are set in motion.

XIX.—In flesh-feeding (200 grams), the total quantity of chyme which passes the various sections of the intestine decreases with each hour of the digestion period. The intervals between the peristaltic propulsions of the chyme are diminished by removal of the pylorus. The chyme is always a thick fluid, although its chemical and physical characters vary as it passes along; it also varies in the concentration of the digestion products in different segments of the intestine.

XX.—An attempt is made to construct mathematical formulæ to show the relationships between the digested, undigested, and absorbed portions of the food in relation to its quantity and the quantity of juices secreted. The experiments on which these are based were made with gliadin as the food.

XXI.—Similar experiments with white of egg; although this is more difficult to digest than gliadin, the same general laws are stated to hold.

XXII.—Loss of blood delays digestion; loss of one-third of the total volume of blood stops it for three hours; during this time the fall of blood-pressure persists. The quality of the blood is also important; in hydræmia there is diminution of gastric activity.

XXIII.—Starch, dextrin, sucrose, and dextrose are not absorbed in the dog's stomach in any concentration, whether dissolved in water or alcohol. Of these carbohydrates, only sucrose and erythro-dextrin undergo slight fission (2—4%) in the stomach, and this is due to the acid, not to enzymes; still large quantities of gastric juice are secreted. No formation of lactic acid was observed. In the duodenum, the carbohydrates undergo fission, the amount of which stated numerically varies in the case of different carbohydrates. Absorption has its main seat in the jejunum and upper ileum; again, the amount is stated numerically. Absorption is completed in the lower ileum; this is usually 100%, or nearly that. Only in the case of dry starch does any important amount (22%) pass through into the large intestine. The intestinal juice appears to be the main agent in the fission of carbohydrates; in starch digestion, however, the duodenal juice is of special importance. This intestinal activity leads to an increase of nitrogenous metabolism, which chiefly shows itself in the secretion of nitrogenous substances into the intestinal lumen.

XXIV.—The fission of emulsified fat begins in the dog's stomach soon after feeding, and reaches about 32%. This is partly due to gastric lipase, and partly to regurgitated duodenal contents. The pancreatic juice in the duodenum acts vigorously, cleaving 41% of the fat. Below this in the small intestine the percentage of free fatty acids reaches its maximum, this in some portions reaching 95%; 69% of the fatty acids are still present in the large intestine.

XXV.—The main protein constituent of the tubercle bacillus approaches in composition those proteins with a mean percentage of diamino-acids. In the upper segments of the alimentary tract, it is digested, and it is absorbed throughout the length of the intestinal canal. In the lower ileum very little digestion of this protein takes place. W. D. H.

Gastric Digestion in Fishes. M. VAN HERWERDEN (*Zeitsch. physiol. Chem.*, 1908, **56**, 453—494).—This investigation definitely proves that the acid of the gastric juice in Selachian fishes is hydrochloric acid. An unimportant amount of formic acid is also present. The results in teleostean fishes are not so clear, mainly owing to the difficulty of collecting the juice during life. During digestion in selachians, the percentage of the acid may rise to 0·4. The proteolytic ferment present is probably pepsin, although some digestion may occur in a neutral medium, and in some teleostean fishes even in an alkaline medium. The acid is secreted at the cardiac region only of the stomach, but the epithelium differs from that seen in higher vertebrates. An amylolytic ferment is absent, but lipase is present. W. D. H.

Influence of Bromine on Gastric Secretion. TOGAMI (*Biochem. Zeitsch.*, 1908, **13**, 112—120).—Experiments on dogs with a Pawloff's "small stomach" show that aqueous solutions of bromine (in contradistinction to iodine) paralyse the stomach glands without any preliminary stimulation. Sodium bromide and bromo-protein compounds act, but not so constantly, in the same direction.

W. D. H.

[Importance of Calcium Salts for the Growing Organism]. ARNOLD ORGLER (*Biochem. Zeitsch.*, 1908, **12**, 334—335. Compare this vol., ii, 606).—Explanation of a misunderstanding of the meaning of the term "balance" in a work by Aron and his collaborators (this vol., ii, 208), and criticised by the writer of the note. S. B. S.

Behaviour of Lecithin with Bile Salts, and the Occurrence of Lecithin in Bile. JOHN H. LONG and FRANK GEPHART (*J. Amer. Chem. Soc.*, 1908, **30**, 1312—1319).—Some authors have stated that bile contains small quantities of lecithin, whilst others have expressed the opinion that this substance is absent. Hammarsten (Abstr., 1901, ii, 520; 1903, ii, 86; 1904, ii, 831), whilst leaving the universal occurrence of lecithin in bile an open question, asserts that it is present in the bile of the polar bear.

Experiments have now been made with ox bile and with human bile, but lecithin could not be separated. It has been found that the bile salts, as usually obtained, carry down a phosphorus complex, which has been regarded by Hammarsten and others as a lecithin. This complex could not be completely removed from the bile salts, as the latter retain it very tenaciously.

Bile salts are capable of dissolving 80% of their weight of egg-lecithin, and much of this can be precipitated with acetone, but a small quantity remains with the bile salts, and is probably much greater than that contained in any bile. The addition of inorganic salts hastens the solution of lecithin by bile salts, but does not increase the amount dissolved. A few inorganic salts, however, such as aluminium and ferric chlorides and lead nitrate, cause the precipitation of the bile acids. When lecithin is dissolved in bile salts, the optical activity is increased, whence it is calculated that the lecithin has $[\alpha]_D + 7{\cdot}75^\circ$. E. G.

Action of Acids and Rennet on Human Milk. ENGEL (*Biochem. Zeitsch.*, 1908, **13**, 89—111).—Hydrochloric, lactic, oxalic, and sulphuric acids precipitate human milk, and the optimal acidity is 2—3 c.c. of $N/10$ acid to 10 c.c. of milk. Phosphoric and acetic acids act best at a greater concentration (5 c.c.); the substance precipitated is caseinogen; rennet precipitates a calcium compound of this protein, and the amount necessary varies within wide limits, but the precipitation is most complete when combined with the optimal concentration of acid. W. D. H.

Fat and Ester Hydrolysis in Tissues. PAUL SAXL (*Biochem. Zeitsch.*, 1908, **12**, 343—360).—In organs containing only their own fat, or with additional added neutral fat, only a small amount of fat hydrolysis takes place during autolysis with exclusion of bacterial action. In the case of the addition of monoacetin, monobutyrin, and ethyl butyrate to organs, the increase of acidity after twenty-four to forty-eight hours is due, at any rate partly, to the formation of acid products of autolysis. Amyl salicylate is, however, hydrolysed by all the organs investigated, with the exception of muscular tissue. The power of ester hydrolysis generally is smaller in the case of the muscles than in all other organs. The hydrolysing power of blood-serum is also small. Phosphorus poisoning does not activate a lipase. None of the methods hitherto employed for determining the fat-hydrolysing power of tissues is quite trustworthy; the quantities of acid formed are too small after short periods of incubation to allow an accurate estimation of their quantity to be made, and the product of autolysis and other circumstances interfere with the correct estimation after longer periods. Any conclusions as to the lipase content of organs under pathological conditions must therefore be accepted with reserve. S. B. S.

Inosite in Animal Tissues and Fluids. FRANZ ROSENBERGER (*Zeitsch. physiol. Chem.*, 1908, **56**, 373—377).—A new method of extraction is described which avoids the faults of Scherer's older method. Fresh flesh contains no inosite (cyclose); it is formed on keeping from a substance named *inositogen*. Ox-blood is free from both substances. Inositogen appears in the human placenta at the sixth month of fœtal life; it is present in fresh eggs. The normal urine of men and dogs contains traces of inosite; that of the rabbit does not. The bodies of rabbits after inanition do not form inosite.

W. D. H.

Muscular Contraction and Receptive Substances. III. John N. Langley (*J. Physiol.*, 1908, 37, 285—300).—The present experiments deal with the action of nicotine on denervated frog's muscles. Up to 100 days after nerve-section, the local punctiform application of nicotine to the muscles causes tonic contraction, as it does in normal muscles; more dilute solutions cause fibrillary twitchings; for this purpose, however, a somewhat stronger solution is required than in normal muscles. It is therefore certain that nicotine produces its effects on muscle and not on nerve-endings. Possibly the contractile molecule of the muscle fibre has a number of receptive side-chains; combination of one of these with nicotine causes one effect, with another, the other effect. Curare prevents nicotine from causing contraction in muscles, whether denervated or not.

W. D. H.

The Physiology of the Glands. IX. The Relationship between the Hourly Excretion of Nitrogen and Resorption from the Intestine, and its Dependence on Rest, Work, and Diuresis. Ernst Haas (*Biochem. Zeitsch.*, 1908, 12, 203—247).—The hourly output of urine and its nitrogen content were estimated after meals containing known amounts of nitrogen, when the subject of the experiment was doing muscular work, when at rest, and when excessive diuresis was produced by drinking large amounts of tea. The curves representing the output were of a fairly constant form. They showed as a rule three maxima, the first in the second hour, the second in the fifth, and the last in the seventh hour. The first maximum is due to a washing-out of nitrogenous metabolism products owing to the introduction of liquids in the meal; the second and third are due to the resorption of the ingested nitrogenous matter from the intestine. Work or rest have no definite influence on the amount of excreted nitrogen in the first eight hours after a meal. With increased diuresis, there is to a certain extent an increased nitrogenous excretion, which is due, not to increased protein decomposition, but to the washing-out of nitrogenous metabolites already existing in the organism. If the diuresis be brought about before the ingestion of a meal, a smaller quantity of nitrogen is subsequently excreted; this quantity under the conditions of experiments performed was a constant, and amounted to 65% of the nitrogen of the ingested food.

S. B. S.

The Elimination of Non-dialysable Substances by the Urine under Normal and Pathological Conditions. Ulrich Ebbecke (*Biochem. Zeitsch.*, 1908, 12, 485—498).—The amount of non-dialysable substance excreted in the urine depends on the amount of substance metabolised. In normal men it varies between 0·870 and 2·356 grams per day—averaging about 1·44 grams. These numbers are markedly higher than those found for females (about 0·8 gram per day). They are also higher than the numbers found in cases of nervous diseases, and of chronic disturbances of the digestive functions. On the other hand, in cases of increased metabolic processes, even with decreased ingestion of food, such as in cases of fever and diabetes, the reverse is the case. The residue, in normal cases, gave, when tested with the majority of the protein reagents, negative results; on hydrolysis with hydrochloric acid it yielded a reducing substance; probably it consists of chondroitinsulphuric acid and nucleic acid. In the case of pneumonia, however, appreciable quantities of a peptone appeared to be present. In composition, this substance was not far removed from that of the mucin of bronchial mucous membrane, and it yielded on hydrolysis a reducing substance. It is possibly a glucopeptone. S. B. S.

Colloid Nature of Pigments in Relation to their Behaviour in the Frog's Kidney. RUDOLF HÖBER and S. CHASSIN (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 76—80).—The experiments described previously (this vol., ii, 716) are extended to twenty-one other dyes. The experiments lead to the following rules: (1) When a dye is not taken up by the kidney epithelial cells it is highly colloidal. The converse is not true, since some colloids are taken up, for example, Biebrich-scarlet, acid-violet, and aniline-blue. (2) When a dye has little or no colloid character, it is readily taken up. T. E.

A Colour Reaction of Pathological Urine. OTTO GAUPP (*Biochem. Zeitsch.*, 1908, 13, 138—141).—Strzyzowski described in diabetic urine a reaction dependent on the amount of acetoacetic acid, the presence of which indicates a bad prognosis; it consists in the appearance of a green fluorescence at room temperature within twenty four to forty-eight hours when formaldehyde is added to the urine. In the present research, it is shown that the prognosis is not necessarily bad, and that the reaction is not specific for diabetic urine, but is found in a large number of other diseases. Ammonia is increased as well as acetoacetic acid in the urine, and a mixture of ammonia, acetoacetic acid, and formaldehyde gives the reaction. The chemical explanation of the reaction is still obscure. W. D. H.

The Relationship of the Thyroid Gland to the Physiological Action of Adrenaline. ERNST P. PICK and FRIEDRICH PINELES (*Biochem. Zeitsch.*, 1908, 12, 473—484).—The effect of adrenaline injection on the glycosuria and blood-pressure in thyroidectomised animals was investigated. It was found, in the case of rabbits, that the extirpation of the thyroid gland produced no effect on the action of adrenaline as regards its properties of producing glycosuria and diuresis, or of raising the blood-pressure. In the case of young goats, the removal of the thyroid, inhibited adrenaline-glycosuria; the diuretic and blood-pressure-raising properties remained, however, intact.

S. B. S.

The Behaviour of Bromides in the Human and in Animal Organisms. II. H. VON WYSS (*Arch. exp. Path. Pharm.*, 1908, 59, 186—195).—The kidneys possess no special capacity for elimination of bromides. After injection of these salts, owing to increased osmotic pressure, the kidneys will become active, but will eliminate, not the foreign salt necessarily, but also the chlorides. There will be, consequently, a chlorine deficit in the organism, and the toxic effects due to bromides are caused by chlorine starvation; the bromides themselves play a purely passive rôle. S. B. S.

Behaviour of Hydroxylamine in the Animal Organism. ROBERTO CIUSA and R. LUZZATTO (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 834—840).—The authors have made a number of experiments on the toxicity of hydroxylamine and on the presence of the latter or its oxidation products in the urine of animals to which hydroxylamine has been administered, either by ingestion or hypodermically; the blood of the animals was examined spectroscopically.

As a poison, hydroxylamine is four to five times as powerful as nitrous acid. In blood *in vitro*, hydroxylamine is oxidised, first to nitrous acid and then to nitric oxide, most probably with intermediate formation of dihydroxyammonia, thus: $NH_2{\cdot}OH \longrightarrow NH(OH)_2 \longrightarrow N(OH)_3$ or $NH_2{\cdot}OH \longrightarrow HNO \longrightarrow HNO_2$ and $HNO + HNO_2 = 2NO + H_2O$. The blood-spectrum indicates the presence of the nitric oxide compound of hæmoglobin, together with methæmoglobin. T. H. P.

Physiological Action of Optical Antipodes on Higher Organisms. GIUSEPPE BRUNI (*Gazzetta*, 1908, **38**, ii, 1—5).—*l*- and *d*-Camphors were administered to a number of pairs of rabbits of about equal weight in the proportion of 1·5 gram of 10% camphor oil per 100 grams-weight of the animal, the times of survival of the rabbits after the injection being measured. In the case of *l*-camphor, the mean period of survival was 25·4 minutes, and for *d*-camphor, 336·7 minutes, so that the toxicity of *l*-camphor is thirteen times as great as that of the *d*-isomeride. Similar results were obtained by experiments on guinea-pigs. The tastes of the two forms of camphor are markedly different, the *l*-isomeride being almost tasteless.

T. H. P.

Behaviour of Dextrosephenylosazone in the Organism. LUCIANO PIGORINI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 132—136).—Experiments on frogs, chickens, guinea-pigs, and dogs to which dextrosephenylosazone was administered, either by ingestion or by subcutaneous or peritoneal injection, show that the animals are not affected by the osazone. The conclusion is drawn that the osazone is not resolved in the organism into dextrose and phenylhydrazine, or that, if such resolution does occur, phenylhydrazine is not set free; phenylhydrazine, when administered in the free state, reduces the oxyhæmoglobin of the blood to methæmoglobin, besides depressing the nerve centres. T. H. P.

The Pharmacology of Phenanthrene and its Hydroderivatives. HERMANN HILDEBRANDT (*Arch. exp. Path. Pharm.*, 1908, **59**, 140—144).—The reduced phenanthrenes are less toxic than phenanthrene itself. The latter is eliminated from the organism in the form of a phenanthrol glycuronate. Dodecahydrophenanthrene, in a rabbit, also gives rise to a glycuronate. In the case of frogs, phenanthrene itself gives rise to a glycuronate, but not 9 : 10-dihydrophenanthrene, or derivatives containing more hydrogen.

S. B. S.

The Quantitative Estimation of Synthetical Muscarine by Physiological Methods. HERMANN FÜHNER (*Arch. exp. Path. Pharm.*, 1908, **59**, 179—185).—Injection of muscarine solutions into the heart of a toad (*Bufo vulgaris*) produces in weak solutions diminutions of amplitude of the beat; in stronger solutions, short cessation, with spontaneous recovery, with periodic beats, and with still stronger solutions, total cessation, lasting for some minutes. By perfusing the heart with Ringer's solution, it readily recovers, and can be employed for further experiments. To test the strength of a solution, the heart is first treated with known strengths of a muscarine solution, and the effects produced by each strength noticed. The heart is then perfused with the muscarine solution under investigation, and from the dilution necessary to produce the various effects, the concentration of the muscarine therein can be ascertained. S. B. S.

The Action of Methyl-green. HERMANN FÜHNER (*Arch. exp. Path. Pharm.*, 1908, **59**, 161—178).—Methyl-green is a true quaternary ammonium base, which cannot be extracted from aqueous solutions by ether. It has, accordingly, a curare-like action, and produces paralysis, acting peripherally. This effect is produced in frogs by doses of 2—4 milligrams. 0·03 Gram per kilo. is the toxic dose for rabbits when injected subcutaneously. Five times this dose, when administered *per os*, is without action. It exerts no muscarine-like action on the heart, but acts on the blood-vessels, causing fall of blood-pressure. Pharmacologically, it stands in the same relationship to the methyl-violet, from which it is produced by methylation, as curarine to curine; methyl-violet, like curine, exerts no curare-like action, but a digitalis-like action on the heart, which is wanting both in methyl-green and curarine. Methyl-violet is adsorbed by filter-paper and charcoal much more readily than methyl-green, and pigments strongly colour the tissues surrounding its point of application and the organs on which it exerts pharmacological action. Methyl-green, on the other hand, does not pigment very much, and is readily excreted by the kidneys. For this reason, the tinctorial power of methyl-green has failed to throw light on the question of the localisation of its curare-like action. S. B. S.

The Pharmacology of the Quinatoxins. HERMANN HILDEBRANDT (*Arch. exp. Path. Pharm.*, 1908, **59**, 127—139).—The products formed in the isomeric change produced by heating the cinchona alkaloids in acetic acid have been termed the quinatoxins. The experiments indicate that the increased toxicity of these products, as compared with the parent substances, is due to the presence of the piperidine group and the free imino-group. The comparative effects of cinchotoxin, methylcinchotoxin, and other derivatives were investigated. S. B. S.

Biochemical Investigations of *p*-Iodophenylarsinic Acid. FERDINAND BLUMENTHAL and FRIEDRICH HERSCHMANN (*Biochem. Zeitsch.*, 1908, 12, 248—251).—*p*-Iodophenylarsinic acid was prepared from atoxyl by slowly diazotising it, and then adding potassium iodide. It is soluble in methyl and ethyl alcohols, but insoluble in other organic solvents, and can be heated to 300° without melting. For physiological investigations, the sodium salt was employed. It is more toxic than atoxyl; 0·1 gram can be injected into rabbits of from 1·5—2 kilograms in weight without marked ill-effects; 0·2 gram is a lethal dose. The animals killed exhibit acute nephritis. The iodine is excreted in the urine apparently in the form of an organic compound, and can be detected therein for some days after the injection. S. B. S.

Beeswax. RAGNAR BERG (*Chem. Zeit.*, 1908, 32, 777—780).—From a study of this wax, the author concludes that yellow beeswax contains aromatic and yellow colouring matters soluble in 80% alcohol and insoluble in light petroleum; chemically-bleached wax contains no such insoluble substances. The odour of the wax appears to be due, in part, to esters of a cholesterol derivative and acetic acid, butyric acid, valeric acid, and an unsaturated liquid acid. The operation of bleaching the wax causes the lower fatty acid esters to decompose. Both bleached and unbleached wax contain at least 0·6% (probably more) of cholesterol esters, which are difficult to saponify, and have high saponification values; only the alcohols give the cholesterol reaction, not the acids. The free wax-acids, which are soluble in 80% alcohol, consist chiefly of unknown acids, together with small quantities of cerotic acid; the bleached wax contains palmitic acid. A supersaturation method is described for showing stearic acid adulteration of beeswax. Dilute acetone, D 0·8450, is used instead of alcohol, enabling so small a quantity as 0·3 gram of stearic acid to be detected in the presence of palmitic and cerotic acids. J. V. E.

Fatty Acids from Mummies. W. A. SCHMIDT (*Chem. Zeit.*, 1908, 32, 769—770).—All mummies of whatever age contain fatty acids, and it is of interest to ascertain the alteration in composition of these acids as time progresses. With this object, mummies from about A.D. 500 and about B.C. 1000 have been investigated. From the lungs and muscles of the more recent, 60% and 20—25% respectively of higher fatty acids have been obtained, 40% of which is oleic acid; practically no volatile fatty acids were present. The lungs and spleen of the older mummies contained respectively 12·5% and 30% of higher fatty acids, relatively less oleic acid, and in proportion to the more recent mummies, a considerable quantity of volatile acids.

The liver of a mummy (B.C. 1000) was found to contain 1·6% volatile fatty acids, which are, for the most part, present as the sodium salt.

The author considers that the presence of higher acids is probably due, in part, to the transformation of the mummified albumin, and that the volatile acids may be derived from the slow decomposition of the higher acids, and not directly from the albumin. J. V. E.

Optical Activity of "Protagon." A New Physical Phenomenon Observed in Connexion with the Optical Activity of So-called "Protagon." OTTO ROSENHEIM and M. CHRISTINE TEBB (*J. Physiol.*, 1908, **37**, 341—347, 348—354).—"Protagon" dissolved in pyridine possesses at 30° a slight dextrorotatory power, which changes to optical inactivity at higher or lower temperatures, showing finally a maximum lævorotation of $-242°$, and a final constant lævorotation of $[\alpha]_D^{20}$ $-13·3°$. The prolonged action of boiling or warm alcohol during its preparation or recrystallisation has no influence on these phenomena. Wilson and Cramer's "decomposition" theory of protagon, based on the change of the specific rotation of protagon in pyridine from $+6·8°$ to $(+?)13·3°$ after the action of warm alcohol, is erroneous, and cannot be used for the revival of the view that protagon is a definite chemical compound.

The explanation of the change is as follows: the diamino-phosphatide, sphingomyelin (the constituent of "protagon" rich in phosphorus), is precipitated, when a solution of protagon is kept; it is the appearance of this precipitate which gives rise to the high lævorotation; as the precipitate settles, the lævorotation decreases, and the final lævorotation is due to a small amount of the precipitate which does not settle. But if the precipitate is removed by filtration or centrifugation, the portion of the protagon which remains in the pyridine solution, and is phosphorus-free, is optically inactive. If the precipitate is once more shaken up with this, high lævorotation is again obtained, which lessens as the precipitate once more settles. The high lævorotation is expressed in the usual way, but the optical activity of the precipitated substance does not follow Biot's laws.

On microscopic examination, the precipitate of sphingmyelin is found to consist of anisotropic globules (fluid sphæro-crystals), and their appearance in polarised light is figured. The term *sphaerorotation* is proposed for this phenomenon.

The majority of the experiments recorded were performed with protagon or sphingomyelin prepared from brain, but a similar substance with the same remarkable properties was also prepared from the cortex of the suprarenal body. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Enzymes [Diastase]. WILHELM SCHNEIDEWIND, DIEDRICH MEYER, and F. MÜNTER (*Bied. Zentr.*, 1908, **37**, 503—504; from *Arb. Agric.-chem. Versuchstat. Halle*, 1906, **2**, 67).—Alcohol and ether have a very injurious effect on the action of diastase, and freshly-prepared solutions of diastase are much more vigorous in action than the precipitated substance. It is therefore impossible to obtain information as to the composition of enzymes by studying substances prepared by precipitation.

Albumin, asparagine, and peptone act favourably, so also do weak acids (citric and acetic) at low concentrations (0·001%), but at higher concentrations (0·010%) they retard the action of diastase. Chlorides of the alkalis and small quantities of monophosphates and of aluminium sulphate accelerate the action. One to 2% of monocalcium phosphate or of aluminium phosphate inhibits action altogether. E. J. R.

Action of Small Quantities of Metals on Lactic Acid Fermentation. CHARLES RICHET (*Bied. Zentr.*, 1908, **37**, 576; from *Compt. rend. Soc. Biol.*, 1905, **60**, 455—456).—Minute amounts of barium, platinum, cobalt, manganese, and vanadium were found to cause a slight acceleration in the rate of production of lactic acid.

E. J. R.

The Catalases of Bacteria. AUGUST JORNS (*Arch. Hygiene*, 1908, **67**, 134—162).—The power of bacteria in bouillon cultures to decompose hydrogen peroxide is due to the presence of a specific catalase, which exists in the form of both an ecto- and endo-ferment. Catalase-formation appears to be a very general property of bacteria, although individual species vary very greatly as regards the intensity of the action. S. B. S.

The Chemical Changes Involved in the Assimilation of Free Nitrogen by Azotobacter and Radiobacter. JULIUS STOKLASA (*Centr. Bakt. Par.*, 1908, ii, **21**, 484—509)—Both *Azotobacter chroococcum* and *Radiobacter* are widely distributed in nature, especially in soils where the bluish-green algæ are numerous; they were not found, however, in the high-lying soils of the Alps. Full details are given of the methods of isolating and studying the organisms.

Experiments on the amount of nitrogen-fixation showed that, contrary to the generally-accepted view, *Radiobacter* has only slight powers of assimilating free nitrogen; thus cultures in 10 and 20 days respectively fixed only 2·2 and 5 milligrams of nitrogen per litre, whilst *Azotobacter* cultures under the same conditions fixed 74·9 and 98 milligrams per litre. Nor is the nitrogen-fixing power of *Azotobacter* greatly increased by symbiosis with *Radiobacter*.

In order that nitrogen-fixation should go on, it is essential that carbohydrate should be supplied, and experiments were made to ascertain the relative values of several sugars. *l*-Arabinose was the most effective, causing 180 milligrams of nitrogen per litre to be fixed; under the same condition, *l*-xylose, dextrose, *d*-galactose, and lævulose enabled 140 to 155 milligrams to be fixed, sucrose 125, maltose 86, but rhamnose only 49·8. The figures for duplicate experiments show somewhat wide variations, but a series of tests with dextrose showed that 99 to 224 grams of this sugar were converted into carbon dioxide and water for every gram of nitrogen fixed. In view of the above results, the author suggests that the furfuroids of the soil furnish the best source of food for *Azotobacter*.

The influence of sodium nitrate on the process was also investigated. This substance inhibits nitrogen-fixation; nevertheless, it is not nearly as useful a food-stuff as free nitrogen. *Radiobacter* is a powerful denitrifier, decomposing the nitrate with liberation of free nitrogen.

Respiration is more intense than in any other organism yet studied, 1 gram of the bacterial mass evolving 1·3 grams of carbon dioxide in twenty-four hours. In addition to carbon dioxide, the following substances are also produced from the sugar: ethyl alcohol, hydrogen, formic, acetic, butyric, and lactic acids. E. J. R.

Effect of Pasteurisation on the Development of Ammonia in Milk. W. G. Whitman and Henry C. Sherman (*J. Amer. Chem. Soc.*, 1908, **30**, 1288—1295).—Experiments which have been made on the pasteurisation of milk at 65° and 85° have shown that it does not entirely destroy the bacteria which attack the proteins with formation of ammonia, but does destroy, sometimes at 65° and always at 85°, the bacteria or enzymes which cause the decrease of ammonia in raw milk. The estimation of ammonia for the purpose of determining the amount of decomposition of proteins in milk is particularly useful in samples which have been pasteurised at a high temperature, but is of less value in samples which have been pasteurised at low temperatures or not at all, since the amount of ammonia present at any given time cannot be assumed to be proportional to the extent to which protein decomposition has taken place. In the case of samples of New York milk, it was found that, in general, pasteurisation was less efficient in checking the development of ammonia than in retarding the production of acid, and this was especially true of milk pasteurised at the higher temperature (85°), which before becoming sour often showed an amount of ammonia considerably in excess of that produced in raw milk of the same age and origin. It was also found that pasteurisation greatly retarded souring, but favoured the development of an offensive odour and bitter taste, this effect being much less noticeable in samples pasteurised at 65° than in those pasteurised at 85°. E. G.

The Photodynamic Action of Plant Extracts Containing Chlorophyll. Walther Hausmann (*Biochem. Zeitsch.*, 1907, **12**, 331—334).—Extracts of various plants containing chlorophyll were shown to exert no hæmolytic action on suspensions of red blood-corpuscles when kept in the dark; if the mixture of corresponding quantities was exposed to light, hæmolysis readily took place.

S. B. S.

Recent Researches on Chlorophyllian Photosynthesis. Eva Mameli and Gino Pollacci (*Atti R. Accad. Lincei*, 1908, [v], **17**, i, 739—744).—A destructive criticism of the work of Usher and Priestley (Abstr., 1906, ii, 299, 881; compare also Ewart, this vol., ii, 217). The statement made by Usher and Priestley that green leaves of *Elodea*, still attached to the plant, do not become reddish-violet when immersed in Schiff's reagent is incorrect. Moreover, when *Elodea*, killed by immersion in boiling water, is placed in pure water, the same bleaching is seen as was observed by Usher and Priestley in a solution of carbon dioxide; it is probably due to the action of oxygen on the chlorophyll, and not to that of carbon dioxide. The experiments on the production of formaldehyde from carbon dioxide in an artificial "cell" composed of glycerol and chlorophyll are valueless, because solutions of chlorophyll always give Schiff's reaction. The evolution of oxygen from these artificial cells as described by Usher and Priestley could not be observed. In conclusion, it is pointed out (1) that these workers did not make any direct experiment to prove the presence of hydrogen peroxide in plants; (2) the function of the catalytic enzymes supposed to decompose the hydrogen peroxide is not demonstrated; (3) that all deductions based on the existence of formaldehyde in the plant after the death of the protoplasm and the bleaching of the chlorophyll are erroneous, because formaldehyde is present in the living green cells; (4) that the photolytic decomposition of carbon dioxide in presence of chlorophyll cannot be realised, much less the production of starch under the conditions given by Usher and Priestley. The only facts established are that the phenomena of assimilation are intimately connected with the production of formaldehyde, and that the latter is localised in the chloroplastids, as was already observed by Kimpflin. W. A. D.

The Translocation of Nitrogen Compounds into the Embryo of Barley from the Endosperm and from Artificial Culture Solutions. HORACE T. BROWN (*Trans. Guinness Lab.*, 1, ii, 288. Compare following abstract).—Germinating barley has been shown to contain in the early stages of its life a variety of nitrogenous substances arising from the protein of the original seed; within the first ten days, at least 35% of the seed protein must be transformed. Not all of the nitrogen compounds found after germination are degradation ("down-grade") products; a certain amount represents the surplus nitrogen over and above that required for immediate tissue formation in the growing embryo, and temporarily accumulated for future use ("up-grade" products). It would be possible to discriminate between the two by stopping the vital activity of the embryo in germinating grain without stopping enzyme action, for example, by treatment with chloroform vapour. Useful light is also thrown on the subject by determining the relative nutrient value of the various nitrogenous constituents of the growing grain when these are presented to the detached embryo in water cultures (compare Brown and Morris, Trans., 1890, 57, 483).

The barley was softened somewhat by steeping, and the embryo removed without injury by means of a small knife. A certain number of the embryos were then placed, scutellum downwards, on disks of porous porcelain immersed in Petri dishes containing the nutrient solution in such quantity that the disk was covered without drowning the embryos. The amounts of mineral matter and of sugar supplied were the same in all experiments, but the nitrogen compounds were varied. The compounds used, and the order of their effectiveness, are as follows: tyrosine and phenylalanine (both poisonous at the concentration used); leucine, malt albumoses, and malt peptones (tend to inhibit growth of the plantlets); choline, betaine, allantoin (directly effective as nutrients, and causing assimilation of nitrogen amounting to nearly 50% of that originally present); ammonium sulphate, aspartic acid, glutamic acid, potassium nitrate, and asparagine show progressive increases in their power to supply nitrogen to the plant.

It is significant that asparagine, the best nutrient found, is much more effective than its hydrolytic products, just as sucrose was found by Brown and Morris to be superior as a nutrient to dextrose and lævulose. E. J. R.

The Soluble and Non-coagulable Nitrogen Compounds in Malt. HORACE T. BROWN (*J. Inst. Brewing*, 1907, **13**, 394—416).—An aqueous extract of malt contains a very complex mixture of nitrogenous substances, even after boiling and removal of the coagulated compounds, and ordinary precipitants were found insufficient to effect complete separations. Thus phosphotungstic acid precipitates about half the nitrogen, but it does not sharply differentiate the complex compounds, and it is possible to isolate both from the precipitate and the filtrate substances having substantially the same properties. Special methods were devised for estimating the nitrogen present as ammonia, and that existing as amides and amino-acids (and therefore liberated by nitrous acid), but these only accounted for 12·5% of the total nitrogen in the extract. An elaborate series of experiments was then made to separate and characterise the remainder of the nitrogen compounds, including salting-out with zinc sulphate and ammonium sulphate, various treatments with alcohol, precipitation with phosphotungstic acid, and the use of dialysis in a special form of dialyser ; as far as possible, the experiments were made quantitatively. In this way, some substances were isolated resembling in their main characteristics the albumoses and peptones which result from the digestion of animal proteins under the influence of animal pepsins. The malt albumoses are neutral, soluble in water, not coagulated by heat, and salted-out by ammonium and zinc sulphates. The malt peptones are readily and permanently soluble in water and strong alcohol, are readily diffusible, and precipitable by phosphotungstic acid. In all these respects they agree with the corresponding animal products ; they differ, however, in not giving the biuret reaction, and in that the malt peptones are not precipitable by ferric ammonium alum. The division of the "non-coagulable" nitrogen in aqueous and dilute alcohol extracts of malt was found to be as follows :

	Aqueous extract of malt.	Dilute alcohol extract of malt.
Nitrogen as ammonia	3·5	2·0
,, ,, amino-acid and amide	8·5	16·0
,, ,, organic bases	4·0	8·0
,, ,, malt albumoses	20·0	16·0
,, ,, malt peptones	31·0	58·0
,, ,, undetermined substances	33·0	—
	100·0	100·0

The amino-acids and amides include asparagine, tyrosine, leucine, and allantoin ; the organic bases are mainly betaine and choline ; the albumoses consist of at least three distinct compounds, and the peptones can be differentiated into at least two.

In examining the several fractions obtained during the investigation of the albumoses and peptones, the author has found the "amino-index" a useful factor. These substances, although neither amides nor amino-acids, liberate a certain amount of their nitrogen on treatment with nitrous acid, and the percentage so liberated is called the amino-index.

Malt albumose I, which represents about one-third of the total albumoses separable by ammonium sulphate, is insoluble in 85% alcohol, and possesses a remarkable power of producing a persistent froth in aqueous solution, a property of considerable interest in connexion with the formation of "head" or foam on malt-worts and beers; its amino-index is 4. Albumose II is soluble in 85% alcohol, and does not possess this frothing power; its amino-index is 5. Albumose III, with amino-index 20, is salted-out with zinc sulphate after removal of Albumoses I and II.

The malt peptones I and II closely resemble each other in general properties, but the amino-index of one is 10·9, and of the other, 19·3.

The author considers that the albumoses and peptones are derived from hordein, the alcohol-soluble protein of barley. E. J. R.

The Protein Changes Taking Place in Green Plants when Kept in the Dark. Wl. Butkewitsch (*Biochem. Zeitsch.*, 1908, 12, 314—330).—The plants employed in the investigations were beans and oats. The total nitrogen was estimated by Kjeldahl's method, the protein nitrogen by that of Stutzer, the aspartic acid nitrogen by that of Sachsse, and the ammonia nitrogen by that of Bosshard. In the case of beans, the undigestible nitrogen and the nitrogen of the substances precipitable by phosphotungstic acid were also estimated. The analyses were carried out with samples of the original material, and also with samples of material which had remained for different lengths of time in the dark. It was found that there was a decrease of protein nitrogen and an increase in aspartic acid nitrogen. The nitrogen, which was due neither to aspartic acid nor protein, at first increased, and then diminished. The conclusion is drawn that part of the aspartic acid (and another accompanying amide) is formed by a secondary change from products of protein degradation, which include leucine and tyrosine. S. B. S.

The Function of Calcium in Plants. Viktor Grafe and Leopold Ritter von Portheim (*Bied. Zentr.*, 1908, 37, 571—572; from *Naturw. Rundschau*, 1907, 22, 255).—The authors find that the injurious effects observed when plants are grown without a proper supply of calcium compounds either fail to appear or are greatly delayed when sugar is supplied. The experiments were made with beans (*Phaseolus vulgaris*), and the sugars investigated were lævulose, dextrose, and sucrose; of these, lævulose was most effective in delaying the effects of calcium starvation. These results lend support to the view that calcium is concerned in the conversion of starch into sugar in the plant.

Experiments were also designed to ascertain whether calcium acts as a protector against the formaldehyde, which may be supposed to be produced during the assimilation of carbon dioxide. Plants were grown in normal solutions and in solutions free from calcium; some were kept in the dark and some in the light. Formaldehyde occurred in all plants exposed to light, but it did not occur in plants kept in the dark, even where calcium was withheld. Nevertheless, the characteristic effects of calcium starvation were seen in the latter case, and these experiments do not show any relation between calcium starvation and presence of formaldehyde. E. J. R.

Occurrence of Calcium Oxalate in the Barks of the Eucalyptus. HENRY G. SMITH (*J. Roy. Soc. New South Wales*, 1905, **39**, 23—32).—The following amounts of calcium oxalate were found in the bark of different species of *Eucalyptus*: *E. gracilis*, 16·66; *E. Behriana*, 16·50; *E. salubris*, 16·00; *E. oleosa*, 10·64; *E. dumosa*, 9·80; *E. salmonophloia*, 8·34; *E. occidentalis*, 6·82; *E. viridis*, 5·01; *E. redunca*, 4·46; *E. polybractea*, 2·14; *E. stricta*, 0·69, and *E. Morrisi*, 0·08%. The calcium oxalate differs from that usually found in plants in having only one mol. H_2O, and in its crystalline form, being similar to the mineral whewellite.

It is suggested that the production of large amounts of oxalic acid may be the cause of stunted growth, and that *Eucalyptus gracilis* is the degenerate form of a larger tree.

The tannin in the barks containing much calcium oxalate is decidedly superior to the tannin of barks in which only small amounts are present. N. H. J. M.

Aluminium, the Chief Inorganic Element in a Proteaceous Tree, and the Occurrence of Aluminium Succinate in Trees of this Species. HENRY G. SMITH (*J. Roy. Soc. New South Wales*, 1904, **37**, 107—120).—Four specimens of *Orites excelsa*, one of the trees known in Australia as "Silky Oak," were found to contain large amounts of aluminium. When excessive amounts of aluminium are taken up by the trees, deposits of basic aluminium succinate are formed. The deposits contain also free butyric acid.

Samples of the wood from (1) Queensland, (2) Mullimbimby, (3) Dorrigo, and (4) Bangalow, contained 0·639, 0·684, 0·673, and 0·706% ash, the composition of which was as follows:

	K_2O.	Na_2O.	CaO.	MgO.	Al_2O_3.	Mn_3O_4.	P_2O_5.	SO_3.	SiO_2.	Cl.	CO_2.
1.	6·98	trace	1·99	3·59	79·61	trace	0·96	0·85	3·64	0·25	2·54
2.	10·91	1·59	11·25	13·87	36·04	3·01	1·31	0·13	0·62	3·03	18·82
3.	14·96	1·13	2·63	16·12	43·03	trace	1·70	0·26	0·36	1·54	(18·62)
4.	—	—	—	—	38·77	0·48	1·26	—	—	—	—

The ash of (2) contained traces of cobalt. Iron was present only in traces.

The sap of *Grevillea robusta* was found to contain butyric acid. No aluminium could be detected in the ash of five varieties of *Grevillea*.

N. H. J. M.

Ochoco Fat. JULIUS LEWKOWITSCH (*Analyst*, 1908, **33**, 313—315).—A fat, consisting of about 98% of myristin and 2% of olein, is yielded by the seeds of *Scyphocephalium ochocoa*, a tree found on the West Coast of Africa. The kernels of the seeds yield about 58·8% of the fat, but by whatever process the fat is prepared, a dark brown colouring matter is at the same time extracted; this colouring matter is contained, not only in the husks, but also in the spermoderm which passes through the whole of the endosperm in the form of irregular lamellæ. The white endosperm, cut out carefully by hand, yielded a fat having the following chemical and physical constants: D^{60}_{4} 0·8899; saponification number, 238·5; iodine number, 1·72; Reichert-Meissl number, 0·65; m. p. 45—48°; unsaponifiable matter, 0·37%; mean molecular weight of the fatty acids, freed from unsaponifiable matter, 221·9; m. p. of fatty acids, 47·2°; the extracted fat had the acid number 1·42. The seeds are obtainable in large quantity.

W. P. S.

Carrotene from Carrots. LEON MARCHLEWSKI (*Zeitsch. physiol. Chem.*, 1908, **56**, 554. Compare Euler and Nordenson, this vol., ii, 724).—The author has shown previously that carrotene when oxidised does not yield a derivative of cholesterol.

J. J. S.

Absence of Gum and Presence of a New Diglucoside in the Kinos of the Eucalyptus. HENRY G. SMITH (*J. Roy. Soc. New South Wales*, 1905, **38**, 21—36).—Freshly-exuded kinos of *Eucalyptus paniculata* yielded a diglucoside, *emphloin*, which is insoluble in alcohol. When hydrolysed, it yields 44·47% of a sugar, from which an *osazone*, m. p. 176—178°, was obtained. The sugar, which is probably isomeric with melibiose, is without optical activity, presumably owing to internal compensation.

When the glucoside is boiled with dilute acid, a precipitate of "kino-red" is produced. This yields protocatechuic acid when heated with potassium hydroxide.

The astringency values of about 100 species of *Eucalyptus* were determined. Compared with gallotannic acid, containing 14·43% of water, = 1000, the values for *E. pilularis*, *E. macrorrhyncha*, and *E. eugenioides* (containing about 18% of water) were 838, 835, and 811 respectively. The kinos of *E. paniculata* and other "iron-barks" have only about half their values, owing to their glucosidal nature, and it will be necessary to hydrolyse the glucoside while in the pits (perhaps by means of an enzyme) to render them suitable as tanning materials.

N. H. J. M.

Barks of Rhamnus Frangula and Rhamnus Purshiana. ALEXANDER TSCHIRCH and J. F. A. POOL (*Arch. Pharm.*, 1908, **246**, 315—325).—The emodins isolated from the two barks are identical; a substance, m. p. 165°, which was, in addition, obtained from Frangula bark, is probably chrysophanic acid; neither bark contains rhein. Tschirch and Edner's assay-method for rhubarb (Abstr., 1907, ii, 515) is not applicable to the barks in question, but Warin's colorimetric method (Abstr., 1905, ii, 659) appears to be of more importance. The addition of magnesia to the powdered drug before percolation, in order to remove the bitter taste from the extract, does not greatly affect the total hydroxymethylanthraquinone-content of the percolate, but increases in it the amount of combined hydroxymethylanthraquinones. G. B.

Origin of the Colour of Red Grapes. PHILIPPE MALVEZIN (*Compt. rend.*, 1908, **147**, 384—386.* Compare Laborde, this vol., ii, 774).—When unripe, green berries of red grapes are heated with distilled water for seventeen hours at 85°, an intense yellow colour is developed, which at the end of twenty-four hours changes to red. The red coloration is due to oxidation by the air, since in absence of air only the yellow colour is obtained. A similar series of colour changes occurs when green berries of white grapes are treated in the same way. The leaves and stalks of the vine, however, give only the yellow colour.

The author ascribes the red colour of grapes to the existence of a single chromogenic compound, which in his experiments is transformed into the red substance under the influence of air, heat, and probably light, the same transformation being brought about in nature by a specific enzyme. The absence of colour in white grapes is considered to be due to the absence of this enzyme. The chromogenic substance is unstable, and is precipitated when the heating at 85° is prolonged; on raising the temperature, however, the original brilliant red colour reappears, and this process can be repeated a certain number of times. W. O. W.

The Action of Sulphur Dioxide on Plants. A. WIELER (*Bied. Zentr.*, 1908, **37**, 572—573; from *Naturw. Rundschau*, 1907, **22**, 229). —Assimilation of carbon dioxide is profoundly influenced by the presence of sulphur dioxide, but respiration is not affected. Examination of the leaves of plants from districts where sulphur dioxide causes injury showed that this substance is present in the leaf, although only in small quantities, except in cases where the leaves are close to the source of origin of the gas, when larger amounts are found. The sulphur dioxide enters through the stomata, and causes greater injury in wet than in dry weather, because the stomata are more widely open.

There is evidence that some other factors come into play besides the direct action of sulphur dioxide in the leaf; for instance, the soils in the districts where injury arises are acid. It is concluded that injury can usually be overcome by suitable manuring, and, in particular, by liming. E. J. R.

The Quantity of Arsenic contained in Wines obtained from Vines which have been Treated with Arsenical Washes. PIERRE BRETEAU (*J. Pharm. Chim.*, 1908, [vi], **28**, 154—158).—Ten samples of wine obtained from vines which had been treated with arsenical washes or sprays were found to contain quantities of arsenic varying from 0·003 to 0·20 milligram per litre; one sample was free from arsenic. Four other samples, also coming from vines similarly treated, but which had received the addition of quantities of sulphuric acid, bisulphite, &c., contained from 0·03 to 0·10 milligram of arsenic per litre. W. P. S.

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* And *Bull. Assoc. chim. Sucr. Dist.*, 1908 **26**, 187—189.

Tobacco-smoke. Josef Habermann and Richard Ehrenfeld (*Zeitsch. physiol. Chem.*, 1908, **56**, 363—372. Compare Abstr., 1901, ii, 680).—An investigation of the amount of ammonia, sulphur, and nicotine in the smoke of various brands of Austrian cigars.

W. D. H.

Composition of the Air in Soils. Erich Lau (*Bied. Zentr.*, 1908, **37**, 433—434).—The author discusses the variations in the amount of carbon dioxide present in the air of the soil. The soil air is richest in carbon dioxide in summer and poorest in winter, the maximum being reached in July, and the minimum in February. Only small amounts are found in sandy soils, more in clays and loams, and a still larger quantity in peaty soils, corresponding with the increasing amounts of humus present; the physical properties of the soil also influence the quantity. Less is found at the surface than lower down; the difference is more marked in the case of peaty than of sandy soils. The amount of oxygen in the soil air depends on the amount of carbon dioxide, hence it is clear that the latter is formed by oxidation of humus.

Some of the carbon dioxide is also produced by the plants growing in the soil, and the amount present in soils carrying crops is always greater than in fallow soils; the amount also increases with the temperature and the weight of the crop. Potatoes and lupins especially cause an increase in the carbon dioxide, indicating that their respiratory processes are more intense than those of other plants.

Dung also increases the amount of carbon dioxide present.

E. J. R.

Some Properties of the Organic Matter in the Soil. The Osmotic Pressure of the Soil Moisture. Josef König, Julius Hasenbäumer, and H. Grossmann (*Landw. Versuchs.-stat.*, 1908, **69**, 1—92).—The authors have examined a method suggested by Coppenrath (*Landw. Versuchs.-stat.*, 1907, **66**, 401) for determining the amount of available plant food in soils, namely, heating the soil (500 grams) with water (5 litres) for five hours under 5 atm. pressure. The plant food goes into solution either as complex salts or as organic substances. Great differences in composition, such as would be found in soils of widely different types, are thus brought out, but not the slight differences produced by adding to a given soil artificial manures in quantities commensurate with those used in practice. Hydrogen peroxide also dissolves plant food from the soil, and in somewhat higher quantities than the above method, but it also fails to discriminate between manured and unmanured soils of the same type when the amount of added manure is only small.

The analytical value of the method was established by pot experiments, which showed that the amount of potash taken by the plant, and therefore "available" for the plant, was much the same as that dissolved by the above processes. Since the amount of plant food dissolved by these methods is higher than that extracted by pure water, or water saturated with carbon dioxide, it follows that some of the soil humus must furnish mineral matter to the plant. For the same reason, potash appears to be set free from some of its insoluble compounds during the growth of the plant.

An apparatus is described by means of which a measure of the osmotic pressure of the soil solution can be obtained. It is suggested that such measurements might throw much light on the solubility of soil constituents. E. J. R.

Isolation of Picolinecarboxylic Acid from Soils and its Relation to Soil Fertility. OSWALD SCHREINER and EDMUND C. SHOREY (*J. Amer. Chem. Soc.*, 1908, 30, 1295—1307).—A sample of soil from Takoma Park, Md., was found to contain 3% of organic matter, 0·1% of nitrogen, and sufficient mineral substances for ordinary crops. Nevertheless, this soil was very unfertile, and did not respond readily to treatment with manures. It was found that this was due to the presence of toxic substances, and a careful investigation was therefore carried out, with the result that picolinecarboxylic acid was isolated.

2-Picoline-4-carboxylic acid was obtained by Böttinger (Abstr., 1881, 612; 1884, 758) by the action of heat on uvitonic acid, the latter being easily prepared by treating pyruvic acid with alcoholic ammonia Indications were obtained of the presence of pyruvic acid in the soil, but no evidence could be obtained of the presence of uvitonic acid.

A series of experiments has been carried out with a view to ascertaining the toxicity of various organic substances on wheat seedlings (compare Schreiner and Reed, this vol., ii, 420). It has been found that picolinecarboxylic acid in very low concentrations acts as a stimulant, but is decidedly injurious when present to the extent of 100—200 parts per million. The amount of picolinecarboxylic acid in the Takoma Park soil was not sufficient to account for the full toxic effect, but this was chiefly due to the presence of dihydroxystearic acid. Uvitonic acid is much more toxic than picolinecarboxylic acid. Pyruvic acid exerts a toxic action, but its sodium salt is inactive. Pyridine and picoline are very injurious, and piperidine is even more so. E. G.

Effect of Lime on the Availability of the Soil Constituents. FREDERICK B. GUTHRIE and L. COHEN (*J. Roy. Soc. New South Wales*, 1907, 41, 61—66).—About 10 lb. of a light sandy soil, a garden loam fairly rich in humus, and a very stiff clay were mixed with 1% freshly-slacked lime and, along with duplicate portions without lime, exposed to the sun and rain for a month, being kept moist the whole time.

The clay to which lime was added became friable in a fortnight. In the soils which had no lime, the water-soluble phosphoric acid decreased considerably, and in the case of the clay soil the water-soluble potassium decreased as well. Application of lime lessened the decrease in water-soluble constituents, and in the sandy soil increased the proportions both of phosphoric acid and potassium soluble in water above those originally present.

The amounts of constituents soluble in citric acid changed very slightly, and the effect of liming was less marked.

As regards the soluble nitrogen, application of lime was found to increase the amount of nitrites, whilst the amount of nitrates remained almost the same, except in the case of the clay soil, which showed a loss of nitrate under the influence of lime. The largest amount of soluble nitrogen in the unlimed soil was in the form of ammonia, of which the limed soil contained very little.

N. H. J. M.

Chemical Examination and Calorimetric Test of Indiana Peats. R. E. Lyons and C. C. Carpenter (*J. Amer. Chem. Soc.*, 1908, **30**, 1307—1311).—Twenty-nine samples of peat from the lake region of Northern Indiana have been tested for calorific value, and five typical specimens of Indiana peats have been submitted to complete analysis. The maximum heating effect was given by a specimen of sphagnum moss peat from a bed 20 feet thick, exhibiting almost complete decomposition and a dark chocolate colour, whilst the minimum effect was given by an impure, highly oxidised peat derived from grass and sedge. In general, the results showed that the best Indiana peat has a calorific value equal to the best grade of peat found in other parts of the United States and in Europe.

E. G.

Manurial Trials with Calcium Cyanamide and (Swedish) Calcium Nitrate. Hjalmar von Feilitzen (*Bied. Zentr.*, 1908, **37**, 498—499; from *Landwirtsch. Presse*, 1907, 229 and 243; see also Abstr., 1906, ii, 487).—The experiments show that calcium cyanamide acts almost as favourably as ammonium salts, although not as well as sodium nitrate, on oats, barley, wheat, and potatoes growing on sandy or clay soils. It also acts well on the better moor soils (Misch- u. Niederungsmooren), but on the poorer soils (sphagnum and high moorland) it was not as good.

Calcium nitrate gave much better results, and was fully as good as sodium nitrate even on the high moorland soils; indeed, on oats it was better than sodium nitrate.

E. J. R.

Pot Experiments to Determine the Limits of Endurance of Different Farm Crops for Certain Injurious Substances. Frederick B. Guthrie and R. Helms (*J. Roy. Soc. New South Wales*, 1904, **37**, 165—171. Compare Abstr., 1905, ii, 755).—The following numbers indicate the percentages of the different substances employed, and their effect on maize grown in a fairly rich garden loam.

	$NaCl$.	Na_2CO_3.	NH_4CNS.	$NaClO_3$.	As_2O_3.
Germination affected ...	0·20	0·20	0·005	0·004	0·50
,, prevented..	0·50	0·50	above 0·02	above 0·006	above 0·80
Growth affected	0·10	0·10	0·001	0·001	0·05
,, prevented	0·25	0·25	above 0·02	0·004	0·60

N. H. J. M.

Amount and Composition of Drainage Waters collected during the Year 1906-7. J. M. Hayman (*Rep. Cawnpore Agric. Stat.*, for the year ending June 30, 1907, 57—58. Compare Abstr., 1907, ii, 127).—Results of analyses, made twice a month, of the drainage through four drain-gauges, two 72 inches and two 36 inches deep, from June 1 to October 31.

The total amounts of rain and drainage, and of nitrogen as nitrates in the drainage, for the five months were as follows:

No.	Depth of soil, in inches.	Rainfall, in inches.	Drainage, in inches.	Nitrogen Per million.	Nitrogen Lb. per acre.
1.........	72	34·38	19·126	41·66	180·31
2.........	72	34·38	16·709	53·03	200·51
3.........	36	34·38	18·257	14·70	60·75
4.........	36	34·38	19·952	18·96	85·62

N. H. J. M.

Analytical Chemistry.

The Importance of Hygroscopy in General Analysis. C. Reichard (*Pharm. Zentr-h.*, 1908, **49**, 759—763).—Attention is directed to the deductions which may be drawn as to the nature of a salt from an observation of its hygroscopic properties. Instances are given of salts which are similar in appearance, but may be distinguished from one another by one having the power of absorbing water from the atmosphere. Thus, a crystal of sodium iodide, exposed side by side with a crystal of potassium iodide, will absorb enough water to give a complete solution, whilst the potassium salt remains practically dry. Barium chloride is readily distinguished from the hygroscopic calcium and strontium chlorides. Sodium metaphosphate is hygroscopic, and differs from sodium orthophosphate in this respect. Other salts exhibiting this difference are potassium acetate and sodium acetate, copper sulphate and copper nitrate, &c. W. P. S.

Qualitative Centrifugal Analysis. B. C. P. Jansen (*Chem. Weekblad*, 1908, **5**, 591—593).—The author finds that the use of the centrifuge in qualitative analysis affords a method which is superior to the ordinary filtration process in speed, ease of manipulation, and cleanliness. Its use is not more expensive than that of good filter-paper. A. J. W.

Gas Analysis. J. P. Wuite (*Chem. Weekblad*, 1908, **5**, 623—625). —A theoretical paper, criticising Anema and van Deventer's conclusions (this vol., ii, 221). A. J. W.

Compound Gas-Pipette. Hans Fleissner (*Chem. Zeit.*, 1908, **32**, 770).—The troublesome operation of filling the compound Hempel pipette is avoided by having a small vertical tube sealed to the communication tube of the central top bulb. When the pipette is filled with the aid of a funnel and a piece of rubber tubing, the tube is closed with a rubber tube carrying a glass rod. L. de K.

Physico-chemical Analysis of Wines. Paul Dutoit and Marcel Duboux (*Compt. rend.*, 1908, **147**, 351—353. Compare this vol., ii, 781).—Berthelot's method for determining the end point in acidimetry by means of the electrical conductivity of the solution, furnishes higher results when applied to the analysis of the distillation products of wines than the usual process. The total quantity of basic substances exceeds the amount of ammonia determined gravimetrically or colorimetrically; the difference represents the volatile organic bases, the quantity of which varies considerably with the nature and age of the wine. The method has also been employed to estimate the volatile acids, but the results are found to depend to a certain extent on the method of carrying out the distillation.

Estimations of the organic bases and colloidal tannins have shown a deficiency of one or both of these constituents in inferior wines ("piquettes") and wines prepared from raisins. W. O. W.

Qualitative and Quantitative Separation of Metals. M. Emmanuel Pozzi-Escot (*Bull. Soc. chim. Belg.*, 1908, **22**, 327—338).—A new course shown in six tables and including the rarer metals. The process much resembles the ordinary course, but deviates from this in the treatment of the filtrate resulting from the action of hydrogen sulphide. This, after expelling the hydrogen sulphide by boiling, is mixed with an excess of sodium hydrogen phosphate, sodium hydroxide, and sodium hypobromite, and again boiled. L. de K.

Detection and Estimation of Free Mineral Acids in Red Wines. Charles Astre (*Bull. Soc. chim.*, 1908, [iv], **3**, 928).—The process depends on the partial separation of the mineral acid from the other constituents of the wine by dialysis. For quantitative purposes, parallel experiments are made with the suspected wine and with one of similar type, the dialysed products being titrated with $N/10$ alkali. Details as to the quantities to be used, &c., are given in the original. T. A. H.

Simple Method for the Estimation of the Halogen in Mercuric Chloride and Mercuric Bromide. Moritz Kohn (*Zeitsch. anorg. Chem.*, 1908, **59**, 271—272).—Mercuric chloride and bromide are decomposed by alkaline solutions of hydrogen peroxide more readily than the iodide (compare this vol., ii, 696). Metallic mercury separates, and is filtered off after the solution has been heated to near its boiling point to remove the excess of hydrogen peroxide. The halogen in the solution is then estimated by means of silver nitrate. H. M. D.

Rapid Estimation of Sulphur in Coals. Abram Komarowsky (*Chem. Zeit.*, 1908, **32**, 770).—A combination of Brunck's process of combustion with cobaltic oxide and sodium carbonate in a current of oxygen (Abstr., 1905, ii, 762) and the author's barium chromate method (Abstr., 1907, ii, 577). L. de K.

Estimation of Sulphur in Mineral Sulphides. V. HASSREIDTER (*Bull. Soc. chim. Belg.*, 1908, **22**, 308—316).—A review of the recent methods proposed, particularly that recommended by Lunge. The author is of opinion that the problem of exact estimation of sulphur is not as yet quite solved, especially in the case of zinc ores.

L. DE K.

Estimation of Sulphurous Acid in Gelatins and other Foods. L. PADÉ (*Ann. Chim. anal.*, 1908, **13**, 299—301).—Twenty grams of dry gelatin, or 100 grams of jelly, are placed in a flask containing 500 c.c. of boiled water. The flask is fitted with a cork through which pass the usual inlet and outlet tubes and also a separating funnel containing 25 c.c. of syrupy phosphoric acid. After twelve hours, a current of carbon dioxide is passed; the liquid is heated at 70°, and the free sulphur dioxide absorbed in nitrogen bulbs containing iodine solution. After an hour, the bulb-tube is changed, the phosphoric acid is introduced from the funnel, and the operation continued for another hour. In this way, the sulphur dioxide present as sulphites is expelled.

The sulphur dioxide is converted by the iodine into sulphuric acid, which is then estimated gravimetrically. L. DE K.

Ammonia Distillation in the Presence of Magnesium or Calcium Salts. PHILIP ADOLPH KOBER (*J. Amer. Chem. Soc.*, 1908, **30**, 1279—1281).—The time required for distilling off the ammonia in Folin's method of estimating carbamide (Abstr., 1903, ii, 116) is three or four times greater than that required for ordinary ammonia distillations. Further, the results of such ammonia distillations show considerable variation, especially when made in the presence of magnesium or calcium salts. These facts are discussed, and an explanation is given.

The solvent action of ammonia or its salts on magnesium hydroxide is due to the following reaction: $MgCl_2 + 2NH_4{\cdot}OH \leftarrow Mg(OH)_2 + 2NH_4Cl$. The liquid from which the ammonia is distilled in Folin's estimation contains a large excess of magnesium chloride, and some ammonium chloride, magnesium hydroxide, and ammonia. As the concentration of the magnesium hydroxide is extremely small and that of the magnesium chloride relatively great, equilibrium will not occur until most of the ammonia is in the form of ammonium chloride. A small amount of the ammonia is removed by distillation, and the equilibrium is disturbed, so that a further quantity of ammonium hydroxide is formed. This gradual change explains the slowness with which the ammonia passes over in carbamide estimations made with magnesium or calcium chloride. It has been found very difficult, if not impossible, to distil ammonia from an alkaline saturated solution of magnesium or calcium chloride. It is therefore evident that quantitative ammonia distillations should not be carried out in the presence of large quantities of magnesium or calcium salts. E. G.

Electrolytic Estimation of Nitric Acid. OWEN L. SHINN (*J. Amer. Chem. Soc.*, 1908, **30**, 1378—1381).—Easton (Abstr., 1904, ii, 84) has studied the reduction of potassium nitrate to ammonia by electrolysis in presence of copper sulphate. A further investigation was made by Ingham (Abstr., 1905, ii, 61), who, by employing a high current density and a rotating anode, obtained very accurate results. As several subsequent workers have been unable to obtain satisfactory results by this method, a series of experiments has been made in order to determine the best conditions. It has been found that Ingham's results can be obtained if the anode is rotated slowly so as to prolong the precipitation of the copper. The current should be about 4—5 amperes and 10 volts, and not more than about 20—25 c.c. of *N*/5 sulphuric acid should be present. It is sometimes necessary to add a second or even a third quantity of copper sulphate in order to complete the reduction. E. G.

Detection of Nitrates in Wine and Must. T. Marsiglia (*Chem. Zentr.*, 1908, i, 2204; from *Staz. sperim. agrar. ital.*, 1908, **41**, 162—170).—One hundred c.c. of the wine are concentrated in a flask to 15 c.c., and, when cold, 6 c.c. of a saturated solution of ferrous sulphate and 4 c.c. sulphuric acid are added and the liquid slowly boiled. By means of a condenser, the vapour is collected in a suitable vessel containing 2 or 3 c.c. of a specially prepared, acidified starch-potassium iodide solution. When nitrates are present in the wine, a blue ring is produced in the starch solution, either at once or in the second or third small fraction, according to the quantity present.

The starch solution is prepared by shaking starch with water, then warming on a water-bath, and adding zinc chloride; after again heating and allowing to cool, the potassium iodide is added. This method of detecting nitrates is not applicable to must, or wine of a high extract content; with such, the following method of Zecchini is advised. The must is evaporated to dryness with fresh lime on a water-bath, and then extracted with 96% alcohol and filtered; the filtrate is evaporated, extracted with water, and then submitted to the test described above for wine. J. V. E.

Detection of Phosphoric Acid in Stones, Ores, and other Minerals. Alexander P. Lidoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 817—822).—The presence of phosphoric acid in minerals may be readily detected as follows: The finely-powdered mineral is first strongly heated in a crucible or iron tube in order to free it from water, organic matter, and carbon dioxide. From 0·080 to 0·100 gram of the cooled mineral is then mixed with approximately 0·3—0·35 gram either of magnesium or of a mixture of about 65% of magnesium and 35% of aluminium. The mass is introduced into an iron tube about 5—6 cm. long and 5 mm. in diameter, a loose plug of asbestos being placed above it. The tube is then heated until the lower end becomes dull red, after which it is rapidly cooled and the contents mixed with a thick wire and introduced into a test-tube with a spherical enlargement at the upper part. In this tube, the substance is gently heated with 20% potassium hydroxide solution, the gases evolved being passed through a calcium chloride tube and a plug of cotton wool, and over a strip of filter paper moistened with copper acetate slightly acidified with acetic acid. If phosphorus is present, the filter paper blackens, owing to the formation of copper phosphide, and in moist air, gradually becomes decolorised, in consequence of the oxidation to colourless copper phosphite.

A dark coloration of the filter paper moistened with copper acetate is also determined by arsenic or nitrogen in the mineral. In the former case, the hydrogen arsenide sometimes gives a characteristic metallic arsenic deposit, which is not easily confused with the blackening due to the formation of copper phosphide, and which remains unchanged in the air. When nitrogen is present in small proportion, the small amount of ammonia evolved simply forms ammonium acetate, and the colour of the filter paper remains unchanged; when much ammonia is evolved, a dark blue solution of copper oxide in ammonia is formed on the filter paper, which changes to the cinnamon colour of cuprous oxide on heating. Experiment shows that magnesium does not absorb an appreciable proportion of nitrogen at a red heat.

T. H. P.

Titration of Phosphoric Acid in Superphosphates. S. KOHN (*Chem. Zeit.*, 1908, 32, 718—719).—A slight modification of the author's process (this vol., ii, 531). Fifty c.c. of the aqueous solution of the sample are diluted with 300 c.c. of water, and titrated with standard sodium hydroxide, using a mixture of methyl-orange and indigotin as indicator. Another 50 c.c. are then mixed with an excess of calcium chloride, and titrated without further dilution, using phenolphthalein as indicator. Salts of iron or aluminium do not interfere.

L. DE K.

Estimation of Phosphoric Acid as Phosphomolybdic Acid. P. CHRISTENSEN (*Zeitsch. anal. Chem.*, 1908, 47, 529—545. Compare Abstr., 1907, ii, 652).—The estimation of phosphoric acid by direct ignition of the precipitate of ammonium phosphomolybdate was found to be trustworthy for the analysis of soils if carried out in the following manner. A known volume of the extract of the soil (equivalent to about 33 grams of the latter) is evaporated to dryness after the addition of a few drops of nitric acid; the residue is then moistened with a little nitric acid, again evaporated, and heated to a temperature of about 120° for fifteen minutes. The residue is next treated with about 25 c.c. of boiling water and a few drops of nitric acid, the silica is collected on a filter, and washed with water until the filtrate measures about 40 c.c. The filtrate is neutralised by the addition of ammonia, D 0·91, a further 8 c.c. of ammonia are added, and then 10 c.c. of concentrated nitric acid. The mixture is heated to about 50°, and, when all the precipitated ferric hydroxide has re-dissolved, molybdic acid solution is run in with constant stirring. About 10 c.c. of the latter solution are added for every 0·1 gram of phosphoric oxide present. After the lapse of three hours, the precipitate is collected on a filter, washed with a 5% ammonium nitrate solution containing 1% of nitric acid, dried, and ignited at a temperature not exceeding a dull red heat; the filter paper is burnt before adding the precipitate to the crucible, and the latter is not covered until the ignition is nearly completed. The weight of the precipitate multiplied by 0·0394 gives the quantity of phosphoric oxide. W. P. S.

Direct Estimation of Phosphoric Acid as Ammonium Phosphomolybdate. Emil Raben (*Zeitsch. anal. Chem.*, 1908, **47**, 546).—As ammonium nitrate is readily soluble in alcohol, the yellow precipitate of ammonium phosphomolybdate obtained in the usual way in the estimation of phosphoric acid may be washed with alcohol, and weighed. The precipitate is collected on an asbestos filter, washed with ammonium nitrate solution, then a few times with warm 70% alcohol, once with absolute alcohol, and, finally, with a little ether. The precipitate is dried to constant weight at a temperature of 110—120°. W. P. S.

Pemberton's Method for the Estimation of Phosphoric Acid. G. H. G. Lagers (*Zeitsch. anal. Chem.*, 1908, **47**, 561—571. Compare Abstr., 1907, ii, 907).—The method was found to give trustworthy results if the solution containing the water-soluble phosphoric acid received the addition of at least 58 milligrams of sulphuric acid before the phosphoric acid was precipitated with the molybdate reagent. When smaller quantities of sulphuric acid (compare Abstr., 1905, ii, 419) were added, the results obtained were too low. W. P. S.

Detection of Traces of Arsenic in Various Substances, and the Sensibility of the Usual Methods. C. H. Nieuwland (*Chem. Weekblad*, 1908, **5**, 558—561).—Sjollema's method (this vol., ii, 224) can be applied to the detection of traces of arsenic in milk, urine, wheat-meal, beef-suet, calico, beer, wall-paper, bones, bone-marrow, and yams. The arsenic was introduced by means of a solution of potassium arsenite containing 0·1 milligram of arsenious oxide per c.c. Gutzeit's test is more delicate; but with not less than 0·05 milligram of arsenious oxide, Sjollema's method enables arsenic to be distinguished from antimony and phosphorus. A. J. W.

Detection of Boric Acid in Foods by means of Turmeric Paper. Francisco P. Lavalle (*Chem. Zeit.*, 1908, **32**, 816—817).—In order to render turmeric paper more delicate, it has been recommended to extract the turmeric powder with benzene before preparing the tincture. The author states that a reaction for boric acid obtained by means of this paper must on no account be taken as proving a wilful addition of boric acid; the reaction is too delicate, showing the (apparent) presence of boric acid even in such reagents as pure hydrochloric acid, sodium chloride, &c. L. de K.

The Estimation of Graphite. Frank Browne (*Chem. News*, 1908, **98**, 51).—The author has studied the influence of heat on the conversion of ferric oxide into the magnetic oxide, and, as a result, has devised the following process for the estimation of graphite: Some ferric oxide is heated to redness in a covered crucible for two to three hours; the resulting oxide is a nearly black, slightly coherent magnetic powder. About 5 grams of this oxide are heated in an uncovered wide mouthed crucible at a pale red heat for an hour, with occasional stirring; after weighing, 0·5 gram of graphite is added and heated as before for one or two hours, with occasional stirring, again weighing. The carbon is burnt off, and the oxide remains unchanged. The results agree fairly closely with those obtained by the potash fusion method. The mineral matter of coal may be estimated in the same way, but the amount found will be about 0·5 per cent. higher than when estimated in the ordinary manner, owing, probably, to interaction of the constituents of the ash. P. H.

Estimation of Potassium in Silicates. WILHELM AUTENRIETH (*Centr. Min.*, 1908, 513—517).—The mineral is decomposed by heating with hydrofluoric and sulphuric acids. When dry, the mass is extracted with boiling water, and the solution freed from iron, etc., by boiling with excess of sodium acetate. After concentrating to about 20 c.c., the potassium is precipitated as cobalt-yellow by addition of 5—10 c.c. of de Koninck's cobalt reagent. As, however, the precipitate is not of constant composition, it is dissolved in hydrochloric acid, and the residue left on evaporation is treated for potassium by the well-known perchlorate method. The potassium may be estimated also by the usual platinic chloride method; in this case, the cobalt must be eliminated by gently igniting the precipitate and extracting the mass with hot water.

The cobalt reagent is prepared by dissolving 30 grams of crystallised cobalt nitrate in 60 c.c. of water, adding 100 c.c. of a saturated solution of sodium nitrite, and then 10 c.c. of glacial acetic acid. After a few days, the reagent is poured off from any deposit, and is then fit for use; it keeps, in the dark, for about a month.

L. DE K.

Estimation of the Alkaline Earths [in Waters] by means of Potassium Stearate and Phenolphthalein. C. BLACHER and J. JACOBY (*Chem. Zeit.*, 1908, 32, 744—745).—The carbonates are first titrated with *N*/10 hydrochloric acid, using methyl-orange as indicator, and the carbon dioxide is removed by a current of air. Phenolphthalein and a few drops of alcoholic *N*-alkali are added, and the liquid is decolorised with *N*/10 hydrochloric acid. After adding an extra 0·02 c.c. of acid, the total hardness is determined by titrating with *N*/10 potassium stearate until the liquid turns red. The calcium is estimated in the presence of magnesium by placing 200 c.c. of the water in a flask and weighing the same. After neutralising with *N*/10 hydrochloric acid, the carbon dioxide is boiled off, 1—3 c.c. of *N*-alcoholic alkali is added, and the loss in weight restored by adding water free from carbon dioxide. The liquid is filtered while still hot, and, when cold, 100 c.c. are neutralised as directed, and the calcium is titrated with the stearate solution. Sulphates may be titrated indirectly by precipitating with a slight excess of barium chloride and determining the excess with the stearate solution, allowance being made for any calcium and magnesium present.

The reagent is prepared by dissolving 28·4 grams of stearic acid in 400 c.c. of hot alcohol and 250 grams of glycerol, and neutralising with alcoholic potassium hydroxide. When cold, the whole is diluted with alcohol to one litre. If desired, the solution may be checked with lime-water and *N*/10 acid. L. DE K.

Volhard's Copper Titration. H. THEODOR (*Chem. Zeit.*, 1908, **32**, 889—890).—Volhard's process (precipitation of copper in presence of sulphurous acid with ammonium thiocyanate and estimation of the excess of the latter with silver solution) is strongly recommended.

L. DE K.

Analysis of Bronzes, Brass, and Similar Alloys. E. SCHÜRMANN and H. ARNOLD (*Chem. Zeit.*, 1908, **32**, 886—887).—The solution of the alloy, which should contain, besides tartaric acid, about 5% of free nitric acid, is submitted to electrolysis; conditions, 1½ amperes and 4 volts. This precipitates the copper only (which, however, should be examined for traces of tin), whilst antimony and tin remain in solution. After rendering alkaline with potassium hydroxide, lead and any copper still present are precipitated by cautious addition of potassium sulphide, and then treated by the usual methods. The filtrate is boiled with addition of 0·5 c.c. of hydrogen peroxide, and, after neutralising with oxalic acid, an aqueous solution of 5 grams of that acid is added. The liquid is diluted to 400 c.c., heated to boiling, and treated with hydrogen sulphide to precipitate the antimony, which is then collected, dissolved in sodium sulphide, and submitted to electrolysis. The filtrate from the antimony is neutralised with ammonia, acidified with acetic acid, heated to boiling, and treated with hydrogen sulphide. The tin sulphide is then converted as usual into tin oxide.

A number of test-analyses are given.

The process is also applicable to the analysis of brass. After the copper has been separated electrolytically, the liquid is treated with hydrogen sulphide, and the precipitate submitted to the usual process. The filtrate containing the zinc is then analysed for zinc in the ordinary way. L. DE K.

Estimation of Manganese in Iron and Manganese Ores. MAX ORTHEY (*Zeitsch. anal. Chem.*, 1908, **47**, 547—560).—The results of a critical examination of some of the methods now in use for the estimation of manganese are given, particular attention being paid to the more rapid volumetric processes. For the estimation of manganese in iron and manganese ores, the methods proposed by Volhard-Wolff, von Knorre (Abstr., 1902, ii, 108), and Blair (Abstr., 1904, ii, 683) were found to be trustworthy, the results obtained agreeing well with those yielded by the ordinary gravimetric method.

W. P. S.

Direct Combustion of Steel for Carbon and Sulphur. HELEN ISHAM and JOSEPH AUMER (*J. Amer. Chem. Soc.*, 1908, **30**, 1236—1239).—Experiments showing that the carbon in steel is almost completely eliminated by direct ignition in a current of oxygen, whereas the sulphur cannot be expelled completely in this manner.

The results for carbon average 0·004% more than those obtained by the usual copper chloride method. L. DE K.

Loss of Carbon during Solution of Steel in Potassium Cupric Chloride. ERNEST P. MOORE and JAS. WATSON BAIN (*J. Soc. Chem. Ind.*, 1908, **27**, 845—846).—In order to ascertain whether there is actual loss of carbon when steel is dissolved in potassium cupric chloride solution, the authors carried out experiments in which the samples of steel were dissolved in the solution in a flask through which a current of air free from carbon dioxide was passed. After leaving the flask, the air was passed over heated cupric oxide, and then through barium hydroxide solution. The barium carbonate formed was collected and estimated. From the results obtained, it is seen that the loss of carbon from 1 gram of steel amounted to from 0·0004 to 0·0005 gram. The two samples of steel used in the experiments contained 0·653 and 1·18% of carbon respectively.

W. P. S.

Pure Ferric Oxide as a Standard Substance for the Estimation of Iron in Hydrochloric Acid Solution. L. BRANDT (*Chem. Zeit.*, 1908, **32**, 812—814, 830—832, 840—843, 851—853).—A lengthy article, unsuitable for adequate abstraction. The chief point is the preparation of a pure oxide of iron, which may then be dissolved in hydrochloric acid, and serve for the standardising of the permanganate after the usual reduction with stannous chloride.

About 50 grams of a commercially-pure iron free from zinc are dissolved in hydrochloric acid, and a current of hydrogen sulphide is passed. The filtrate is boiled, and oxidised with nitric acid. The solution is concentrated, and evaporated twice with hydrochloric acid. The mass is dissolved in hydrochloric acid, D 1·104, and shaken repeatedly in a separating funnel with ether, which dissolves the ferric chloride. Should the iron contain cobalt, this will also pass into the ether, but may be removed by shaking the ether with 1/10 of its volume of hydrochloric acid, D 1·104, saturated with ether. The ether is evaporated, and the residual ferric chloride converted into nitrate by repeated evaporation with excess of nitric acid, and, finally, with addition of ammonium nitrate. The dry mass is now ignited in a platinum dish, finally with addition of ammonium carbonate, until the weight is constant to about 0·01 gram.

L. DE K.

Detection and Estimation of Nickel and Cobalt. M. EMMANUEL POZZI-ESCOT (*Chem. Zeit.*, 1908, **32**, 804).—A reply to Grossmann (this vol., ii, 230). The author upholds the accuracy of his own molybdate process. L. DE K.

Ammonium Molybdate as a Reagent for Nickel. HERMANN GROSSMANN and BERNARD SCHUCK (*Bull. Soc. chim.*, 1908, [iv], **3**, 894. Compare this vol., ii, 230).—A reply to Pozzi-Escot (this vol., ii, 231). T. A. H.

Detection of Chromium. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 333).—The solution, which, besides chromium, may contain a large excess of iron, manganese, cobalt, nickel, copper, &c., is heated to boiling, a solution of sodium hypobromite containing a large excess of alkali is added, and the boiling is continued for a few minutes. When cold, the solution is filtered, and the chromate formed is identified by the usual tests, such as lead acetate and acetic acid.

L. DE K.

Estimation of Chromium and Tungsten in Steel. F. WILLY HINRICHSEN and LUDWIG WOLTER (*Zeitsch. anorg. Chem.*, 1908, **59**, 183—197).—Attempts were made to separate tungsten and chromium by precipitating the former as tungstic acid with nitric acid, but the precipitation was incomplete. On the other hand, reduction of the chromate to chromic salt and precipitation with ammonia gave too high results. Good results were finally obtained by precipitating the tungsten (and a small part of the chromium) with benzidine hydrochloride according to Knorre (Abstr., 1905, ii, 286), the amount of chromium in the precipitate being determined by oxidising to chromate and estimating with potassium iodide and thiosulphate in the usual way. With certain precautions, the presence of tungstic acid does not interfere with the iodometric estimation of chromium.

In the presence of chromium, the results for tungsten obtained by the benzidine method are somewhat too low, and this point is under investigation.

On the other hand, satisfactory results for both metals were obtained by precipitating both chromium and tungsten from an aliquot part of the solution by means of mercurous nitrate (Berzelius) and estimating the chromium in another portion of the solution by the iodometric method. The precipitation is done as follows: To a portion of the solution containing chromate and tungstate, heated to boiling, a saturated solution of mercurous nitrate is added, and then 10% ammonia added drop by drop until the precipitate becomes dark brown. The mixture is then boiled, filtered, dried, ignited, and the mixture of acids weighed.

G. S.

Estimation of Vanadium, Molybdenum, Chromium, and Nickel in Steel. ANDREW A. BLAIR (*J. Amer. Chem. Soc.*, 1908, **30**, 1229—1233).—Two grams of the sample are converted into syrupy ferric chloride, which is then dissolved in a little hydrochloric acid, D 1·1. The solution is shaken first with 80 c.c. and then again with 50 c.c. of ether, which dissolves the iron and also the molybdenum. The ether is then shaken with water, and the aqueous solution evaporated with excess of sulphuric acid. The ferric sulphate is then dissolved in water, and reduced by boiling with ammonium hydrogen sulphite. The molybdenum is precipitated by means of a current of hydrogen sulphide, collected in a Gooch crucible, and converted into trioxide by cautious ignition. As it always contains a little iron, it is dissolved off the filter by means of dilute ammonia, and the crucible is re-weighed.

The liquid which has been extracted with ether is repeatedly evaporated with nitric acid to a syrupy condition, dissolved in 20 c.c. of hot water, and, after reducing any chromate formed by means of sulphurous acid, poured into a boiling 10% solution of sodium hydroxide. The precipitate contains the oxides of chromium and nickel, also the bulk of the manganese, and traces of iron and copper. The filtrate, which contains the vanadium and sometimes a trace of chromium, besides any silica and alumina, is acidified faintly with nitric acid, and then again rendered slightly alkaline and boiled to remove the last traces of chromium. To the filtrate are added 10 c.c. of 10% lead nitrate and then a little acetic acid, and, after boiling for a few minutes, the lead vanadate is collected and evaporated with a large excess of hydrochloric acid to effect reduction. The hydrochloric acid is then completely expelled by evaporation with 10 c.c. of sulphuric acid, and the residue, after being diluted to 150 c.c., is titrated for vanadium at 60—70° with standard permanganate. The filters containing the two precipitates from the soda solution are burnt, and the ash fused with 2 grams of sodium carbonate and 0·5 gram of potassium nitrate. The mass is then extracted with water. The insoluble portion contains nickel, copper, iron, and part of the manganese. It is dissolved in hydrochloric acid, the copper is removed by hydrogen sulphide, and the filtrate evaporated with excess of sulphuric acid. The residue is diluted with water, excess of ammonia is added, and the nickel deposited electrolytically. The filtrate, which contains the chromium and the remainder of the manganese, is mixed with excess of ammonium nitrate and evaporated with addition of ammonia; this precipitates the manganese, also any silica and alumina. The filtrate is then boiled, reduced with sulphurous acid, and the chromium precipitated by ammonia and weighed as oxide.

L. DE K.

Estimation of Vanadium in Iron and Steel. EDWARD DE MILLE CAMPBELL and EDWIN LEGRAND WOODHAMS (*J. Amer. Chem. Soc.*, 1908, **30**, 1233—1236).—Five grams of the sample are dissolved in dilute sulphuric acid, and the insoluble matter, which contains part of the vanadium, is collected and burnt, and finally treated with hydrofluoric acid to expel silica. The soluble portion is treated with hydrogen sulphide and evaporated to about 35 c.c., and the greater portion of the ferrous sulphate precipitated by addition of 100 c.c. of alcohol. The filtrate is oxidised with hydrogen peroxide, boiled, and precipitated with sodium carbonate. The precipitate is collected, and to it is added the residue from the first step of the analysis. The whole is fused with sodium carbonate, and then 300—400 milligrams of charcoal are added and the heating continued for ten minutes in the covered crucible. The object of the charcoal is to reduce any chromate formed; sodium vanadate is not affected.

The mass is now extracted with hot water, 10 c.c. of sulphuric acid, D 1·51, are added, and then 3—4 c.c. of 3% potassium permanganate. After boiling for five minutes, sulphurous acid is added until the permanganate has been reduced and the vanadic acid converted into the blue divanadyl sulphate. The solution is then evaporated until sulphuric fumes appear, and, when cold, water is added up to

60 c.c. and the warm liquid titrated with $N/20$ permanganate, 1 c.c. of which $= 0{\cdot}00256$ gram of vanadium. L. de K.

Estimation of Alcohol in Fermented Liquids. Wm. Antoni (*J. Amer. Chem. Soc.*, 1908, **30**, 1276—1278).—The wine or other alcoholic liquid is introduced into a specially constructed pyknometer of the Sprengel type, brought to the required temperature by immersion in a bath, and weighed. By means of a rinsing arrangement, the wine is introduced into the distilling flask, and the distillate is collected in the pyknometer, which is then carefully filled up with water and re-weighed. For details, the original paper and illustrations should be consulted. L. de K.

Detection of Formaldehyde. Franz von Fillinger (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 226—231).—The paper is written with the object of drawing general attention to the usefulness of the test described by Hehner for the detection of formaldehyde. The author discusses the chemistry of the reaction (compare Abstr., 1907, ii, 512), and gives general directions for its application. W. P. S.

The Value of the Different Methods Used for Estimating Sugar in Urine. Casimir Funk (*Zeitsch. physiol. Chem.*, 1908, **56**, 507—511).—Bertrand's method for estimating sugars (Abstr., 1907, ii, 136) gives very good results for urines, except when β-hydroxybutyric acid is present.

Bang's method gives good results with pure sugar solutions, but not with urines. Borchardt's suggestion, that diabetic urine contains an unknown lævorotatory sugar, is not accepted. J. J. S.

Estimation of Reducing Sugars. Fritz Zerban and W. P. Naquin (*J. Amer. Chem. Soc.*, 1908, **30**, 1456—1461 *).—The cuprous oxide formed by the action of the reducing sugar on Fehling's solution is collected in a Munro-Neubauer crucible, and the precipitate is converted into copper oxide by heating for ten minutes over a Bunsen. flame.

In some cases there may be present co-precipitated mineral matter; the real amount of copper oxide must then be estimated by some accurate method, such as Low's volumetric process.

Some sugars contain reducing substances other than sugar. In such cases, clarification with normal lead acetate is resorted to, which will partly remove such matters. L. de K.

Detection and Identification of Certain Reducing Sugars by Condensation with *p*-Bromobenzylhydrazide. E. C. Kendall and Henry C. Sherman (*J. Amer. Chem. Soc.*, 1908, **30**, 1451—1455).—The reagent is prepared by heating on a water-bath a mixture of 10 grams of ethyl *p*-bromobenzoate, 8·2 grams of a 50% aqueous solution of hydrazine hydrate, and 12 c.c. of 95% alcohol. After four hours, the alcohol is distilled off, and the residue, after being washed with ether, is recrystallised from alcohol.

The test is applied by heating about 0·03 gram of the sugar with twice its weight of the reagent in presence of alcohol. After evaporating three or four times with alcohol, the residue is boiled with chloroform and a few drops of water, which leaves the condensation product undissolved. The reaction is obtained with dextrose, galactose, mannose, and arabinose; not with lævulose, maltose, or lactose, and only to a slight extent with xylose.

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* and *Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 177—182.

The *p*-bromobenzylhydrazone of galactose is insoluble in boiling alcohol, those of mannose and arabinose are dissolved partly, whilst that of dextrose is completely dissolved. The non-reacting sugars, however, interfere with the formation of the dextrose hydrazone to an extent comparable with the interference of maltose and lactose in the ordinary osazone reaction for dextrose. L. DE K.

Test for Pentoses with Orcinol and Hydrochloric Acid. J. PIERAERTS (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 46—62).—Sugars with a keto-group, such as lævulose, produce colorations with orcinol and hydrochloric acid which obscure the colour given by pentoses; hence lævulose and its anhydrides should first be eliminated by fermentation with yeast. In employing the orcinol reagent of Tollens, it is advisable to add an additional volume of concentrated hydrochloric acid to the mixture of one volume of the reagent with one volume of the pentose solution. G. B.

Formic Acid in Glacial Acetic Acid. H. OST and F. KLEIN (*Chem. Zeit.*, 1908, **32**, 815—816).—Wegener's process for formates is recommended. Ten c.c. of the sample are heated with 50 c.c. of sulphuric acid in a flask from which the air has been expelled by a current of carbon dioxide. The mixture is heated on the water-bath for one hour, and the gas evolved collected, with the usual precautions, over aqueous potassium hydroxide; 100 c.c. of carbon monoxide = 0·2056 gram of formic acid.

Good results are also obtainable in the case of weaker acids with Lieben's permanganate or Macnair's dichromate process, or with the mercuric chloride reduction method. L. DE K.

Estimation of the Acidity of Wines. G. FAVREL (*Ann. Chim. anal.*, 1908, **13**, 315—316).—Three official methods are in use. Titration with sodium hydroxide, using phenolphthalein as indicator; the same, using red litmus paper; titration with lime water until a grey, flocculent precipitate forms. The author states that there is a great discrepancy between the results obtained by the first and the last two methods, and expresses the hope that analysts will adopt a definite process. L. DE K.

Indirect Estimation of the Acidity of Wines. G. FAVREL (*Ann. Chim. anal.*, 1908, **13**, 343—346).—Ten c.c. of the wine free from carbon dioxide are placed in a separating funnel, and 20 c.c. of *N*/20 sodium hydroxide free from carbonate are added. A quantity of benzoic acid, known from a previous experiment to neutralise exactly the soda, is introduced, and the whole is well shaken. The liquid, which now contains free benzoic acid equivalent to the acidity of the wine, is shaken twice in succession with 40 c.c. of ether, and this is slowly distilled until about 20 c.c. are left. The residue is allowed to evaporate in a beaker, and the flask is rinsed first with 10 c.c. and then with 5 c.c. of alcohol, which is poured into the beaker. The alcoholic solution is then titrated with $N/20$ sodium hydroxide, using phenolphthalein as indicator. L. de K.

New Method of Estimating the Fixed and Volatile Acids in Wine. M. Emmanuel Pozzi-Escot (*Compt. rend.*, 1908, **147**, 245—247; *Bull. Soc. chim. Belg.*, 1908, **22**, 338—340; *Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 68—69).—The method is based on the transformation of the barium salts of the fixed acids into carbonates by suitable heating and titration of these by standard acid. Two samples, each of 100 c.c., are concentrated to 3—4 c.c. in flat porcelain capsules. The product of the first is treated with an excess of alcohol, filtered, and the filter calcined in a muffle furnace. The alkalinity of the ash is determined by titration with standard nitric acid, using methyl-orange as indicator. The second sample, after evaporation, is neutralised with baryta, and treated with 100 c.c. of a 2% solution of barium bromide in alcohol (96%). The barium salts of the fixed organic acids (except lactic acid) are precipitated immediately and completely; they are filtered off, washed with strong alcohol (in which the barium salts of the volatile acids are soluble), drained, and calcined in a porcelain capsule in a muffle furnace. The carbonates formed are titrated against standard nitric acid, and the result, after deduction of the value obtained from the first experiment, corresponds with the acidity of the wine due to the fixed acids. Subtraction of the acidity due to the fixed acids from the total acidity of the wine, determined on 100 c.c., using phenolphthalein as indicator, gives the acidity due to the volatile acids. The author claims that the method is rapid and simple. It is only applicable to the estimation of organic acids, and is inexact in the presence of lactic acid, but the presence of the latter in wines is quite exceptional. E. H.

The Natural Citric Acid of Wine. E. Dupont (*Ann. Chim. anal.*, 1908, **13**, 338—343).—A study of the Denigès mercury test for citric acid. Most wines from the South of France give the reaction, but, unless they are preserved by mean of sulphur dioxide, the acid disappears within a few months. The author thinks the reaction may be made approximately quantitative. As comparison liquid should be used a wine itself free from citric acid, but to which a known quantity of the acid has been added. L. de K.

Estimation of Malic Acid in Food Products. H. W. Cowles, jun. (*J. Amer. Chem. Soc.*, 1908, **30**, 1285—1288).—The process is devised for the estimation of malic acid in maple products, but may, of course, be applied to other products, such as cider, cider vinegar, etc.

6·7 Grams of the sugar or syrup are dissolved in 5 c.c. of water, and 2 c.c. of 10% calcium acetate are added, followed by 100 c.c. of 95% alcohol, and the whole is warmed on the water-bath until the precipitate has settled completely. The precipitate is washed free from soluble matters with 85% alcohol and then burnt to carbonate. This is then estimated as usual by dissolving in $N/10$ hydrochloric acid and titrating back with $N/10$ sodium hydroxide. The alkalinity represents the malic acid. L. DE K.

Estimation of Tartaric Acid in the Presence of Malic and Succinic Acids. L GOWING-SCOPES (*Analyst*, 1908, **33**, 315—319).—The author has submitted the method proposed by Ferentzy (Abstr., 1907, ii, 991) to a critical examination, and finds that it is trustworthy. It is stated, however, that more accurate results may be obtained by titrating the magnesium basic tartrate with potassium permanganate than by igniting it as recommended by Ferentzy. The method may be applied to the estimation of tartaric acid in fruit juices, and in wines if the tannic acid is first removed. W. P. S.

Estimation of Lactic Acid; Comparison of Methods. JOSEF TRUMMER (*Chem. Zentr.*, 1908, ii, 101; from *Zeitsch. landw. Vers.-Wesen Oesterr.* 1908, **11**, 492—505. Compare Abstr., 1903, ii, 189).—The method of Kunz (Abstr., 1901, ii, 700), with some slight modification, is applicable in all cases for the estimation of lactic acid, and gives more trustworthy results than does the method of Möslinger (Abstr., 1902, ii, 181). J. V. E.

A New Process for the Estimation of Lactic Acid in Organs and Animal Fluids. I. Estimation of Lactic Acid in Aqueous Solutions. ERNST JERUSALEM (*Biochem Zeitsch.*, 1908, **12**, 361—378).—The lactic acid is estimated by oxidising to acetaldehyde: $CH_3\cdot CH(OH)\cdot CO_2H + O = CH_3\cdot CHO + CO_2 + H_2O$, and estimating the aldehyde thus formed by treating with excess of iodine in alkaline solution, and afterwards estimating the excess not used for the formation of iodoform from the aldehyde. To get trustworthy results, the oxidation must be carried out by warming the liquid containing the lactic acid with sulphuric acid, and adding permanganate solution to the boiling mixture. The aldehyde as it is formed must be removed as quickly as possible from the boiling liquid; this is accomplished by means of a current of air. The apparatus for the absorption of the aldehyde must also be very efficient, and one, specially devised, is figured in the original paper. In animal tissues, other substances are found which will interfere with the accuracy of the determinations, especially the sugars and acetone. Tissues must therefore be evaporated down and extracted with ether, and the lactic acid estimated in the ethereal extract. S. B. S.

A New Process for the Estimation of Lactic Acid in Organs and Animal Fluids. II. Estimation of Lactic Acid in Animal Fluids. ERNST JERUSALEM (*Biochem. Zeitsch.*, 1908, **12**, 379—389).—In estimating the lactic acid in animal tissues and liquids, the acid must be first extracted with ether (see preceding abstract). Quantitative extraction can only be accomplished when the liquid to be extracted is so concentrated as to be of pasty consistency. A special apparatus for the extraction of such liquids is figured and described in the paper, and also the application of the method to special cases, such as the estimation of lactic acid in blood, milk, urine, &c. S. B. S.

Detection and Estimation of Boric Acid, Salicylic Acid, and Benzoic Acid in Foods, etc. WILHELM VON GENERSICH (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 209—225).—The results of a critical examination of many of the methods proposed for the detection and estimation of these acids are given. Amongst others, the method described by Windisch (Abstr., 1905, ii, 554) was found to be trustworthy for the estimation of boric acid, as was also Freyer's iodometric process for estimating salicylic acid. Benzoic acid is best extracted from food materials by means of benzene, or mixtures of the latter with light petroleum. The benzene solution of the acid may be evaporated after the addition of ammonia, or a portion of it may be titrated with standard alkali solution. W. P. S.

Detection of Benzoic Acid in Butter. GEORGES HALPHEN (*J. Pharm. Chim.*, 1908, [vi], **28**, 201—203 *).—The test proposed is a modification of that described originally by Mohler, in which the benzoic acid is converted into ammonium diaminobenzoate; this salt, when treated with alkalis, gives a brownish-red coloration. The butter to be tested is melted, together with sufficient lime-water, to render the aqueous portion distinctly alkaline; after cooling, the aqueous portion is separated, rendered acid with phosphoric acid, and shaken out with ether. The ethereal extract is evaporated at the ordinary temperature, and the dry residue is dissolved in 2 c.c. of sulphuric acid, the mixture being heated slightly to dissolve the benzoic acid. When cold, 0·2 c.c. of fuming nitric acid is added, the solution is transferred to a test-tube, and heated, with constant agitation, over a small flame until it boils. The heating is then continued, without agitating the contents of the tube, until sulphuric acid vapours commence to be evolved. After cooling, 6 c.c. of water are added, and then saturated sodium sulphite solution, drop by drop, until all the yellow vapours have disappeared. Ammonia is then allowed to flow over the surface of the liquid, when, if benzoic acid is present, an orange-red coloration is obtained, the intensity of which depends on the quantity of benzoic acid in the sample. W. P. S.

Separation and Estimation of Salicylic Acid and Methyl Salicylate; Hydrolysis of Methyl Salicylate. H. D. GIBBS (*J. Amer. Chem. Soc.*, 1908, **30**, 1465—1470).—*Estimation of Free Salicylic Acid in Oil of Gaultheria.*—Five to twenty c.c. of the ester are shaken with an equal volume of water, and titrated with *N*/50 sodium hydrogen carbonate, using Congo-red as indicator.

Preparation and Estimation of Salicylic Acid and Methyl Salicylate in Foods and Drugs.—The substance is extracted with *N*-sodium hydrogen carbonate, which dissolves the salicylic acid and also a portion of the ester; the remaining ester is recovered by acidifying with dilute sulphuric acid, and distilling in a current of steam; the ester is then shaken out with chloroform. The filtrate is shaken with chloroform to remove the dissolved ester, and the salicylic acid is recovered from the alkaline solution by acidifying and shaking with chloroform ; finally, the acid is determined colorimetrically.

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* and *Ann. Chim. anal.*, 1908, **13**, 382—384.

The chloroform extracts containing the ester are boiled in a reflux apparatus with excess of potassium hydroxide, and the salicylic acid formed is then estimated as directed.

For the methods of studying the rate of saponification of the ester by sodium hydroxide and carbonate, the original article and curve should be consulted. Methyl salicylate, on keeping, always becomes slightly hydrolysed. L. de K.

Characteristic Test for Hippuric Acid [in Urine]. William M. Dehn (*J. Amer. Chem. Soc.*, 1908, **30**, 1507—1508).—A few c.c. of the urine are treated in a test-tube with sodium hypobromite just sufficient to decompose the carbamide and impart a permanent, yellow colour. The solution is then heated to boiling, when, should hippuric acid be present, an orange or brownish-red precipitate is formed, which, however, consists partly of earthy phosphates.

The nature of the red precipitate, which contains nitrogen and bromine, has not yet been fully investigated. It is soluble in most of the organic solvents and in carbon disulphide. L. de K.

Apparatus for Estimating the Expansion of Oils and Other Liquids which Boil above 100°. Wilhelm Thörner (*Chem. Zentr.*, 1908, i, 2001—2003 ; from *Zeitsch. chem. Apparatenkunde*, 1908, 3, 165—168).—The estimation of the expansion of oils and fats between 0° and 100° is advised as an additional means of identification. A Jena glass flask, having a long neck, which is graduated in 1/10 c.c. from the top downwards, and having a capacity of exactly 100 c.c. of distilled water at 100°, is nearly filled with the oil to be tested. The flask is then heated in a suitably arranged steam jacket to 100°, when the volume is made up exactly to the zero mark. The flask and contents are then placed in an ice-chest to cool down to 0°, when the difference in volume may be observed on the graduated neck of the flask. A table of results obtained with thirty-three substances is given, and it is shown that by this method the amount of acetic acid in water solutions may be estimated with a fair degree of accuracy. J. V. E.

A New Reaction for Distinguishing between Heated and Unheated Milk, and for the Detection of Hydrogen Peroxide in Milk. W. Percy Wilkinson and Ernest R. C. Peters (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 172—175).—The test is similar to the well-known *p*-phenylenediamine test, but benzidine is used in place of the latter. Ten c.c. of the milk to be tested are treated with 2 c.c. of a 4% alcoholic benzidine solution, from two to three drops of acetic acid, and 2 c.c. of a 3% hydrogen peroxide solution. With unheated milk, a blue coloration appears at once, whilst if the milk has been heated to a temperature of, or exceeding, 78°, no change in colour takes place. The test is stated to be more sensitive than the *p*-phenylenediamine reaction, and may be used, conversely, for the detection of hydrogen peroxide. W. P. S.

Detection of Small Quantities of Turpentine in Lemon Oil. E. M. CHACE (*J. Amer. Chem. Soc.*, 1908, **30**, 1475—1477).—Fifty c.c. of the sample are distilled in a Ladenburg 3-bulb flask. The first 5 c.c. of the distillate are mixed with an equal volume of glacial acetic acid and cooled in a freezing mixture, 5 c.c. of ethyl nitrite are added, and, after mixing, 2 c.c. of strong hydrochloric acid are added drop by drop. After fifteen minutes, the deposit is collected on a Büchner funnel, using filter-paper under vacuum. The crystals are washed with about 50 c.c. of 95(vol.)% alcohol, and the filtrate is replaced in the freezing mixture in order to obtain a second crop of crystals; after passing the liquid through the same filter, the crystals are washed with strong alcohol and dried.

The crystals are now dissolved in a small quantity of chloroform, and hot methyl alcohol is added until crystallisation sets in, when the liquid is cooled. More methyl alcohol is then added, and the crystals are collected. For microscopical examination, they may be mounted in olive oil. Turpentine yields very characteristic crystals.

L. DE K.

Some Reactions of Terpin. E. ISNARD (*Ann. Chim. anal.*, 1908, **13**, 333—334).—*Action of Reagents on Crystallised Terpin.*—Moistened on a watch-glass with sulphuric acid, a coloration varying from chrome-yellow to salmon-rose is developed. At the same time, the terpin dissolves and emits a characteristic, aromatic resinous odour. On adding a 10% solution of sodium hydroxide, the colour disappears, but the odour becomes still more pronounced. Syrupy phosphoric acid behaves similarly, but no coloration is noticed until heat is applied. If terpin is dissolved in sulphuric acid and then acted on with nitric acid, a yellow coloration is observed, with formation of brown streaks; the solution then becomes colourless and resinified. If nitric acid is added first, the terpin dissolves to a colourless solution, but if now a drop of sulphuric acid is put on the centre, a red spot is formed surrounded by a salmon-rose zone. Terpin shows reducing properties, reducing molybdic and chromic acids in presence of sulphuric acid, and also an acid solution of ferric chloride and potassium ferricyanide.

Action of Reagents on the Alcoholic Solution of Terpin.—Sulphuric acid turns salmon-rose, whilst the alcoholic solution remains colourless. The coloration disappears on shaking, unless the solutions are very concentrated. With a solution containing 200 c.c. of 15% ammonium molybdate, 10 c.c. of sulphuric acid, and 30 c.c. of nitric acid, a blue coloration is obtained, which takes a long time to develop. After about an hour, it becomes indigo-blue, and after twenty-four hours it has changed to bluish-green. The colouring matter is soluble in chloroform. A white deposit is also formed, but this is probably ammonium molybdate precipitated by the alcohol. When heat is applied, the coloration is developed more rapidly, but soon fades; in this case, the characteristic odour is also noticed. L. DE K.

General and Physical Chemistry.

Ultraviolet Spectrum of Silicon. Antoine de Gramont and Charles de Watteville (*Compt. rend.*, 1908, **147**, 239—242).—The ultraviolet spectrum of silicon containing both lines and bands has been mapped between λ2123·0 and λ2987·8. The spectrum of the oscillating spark passing between silicon poles in hydrogen in a quartz tube gave 23 lines and 14 bands, whereas the flame spectrum obtained by burning ordinary gas impregnated with silicon chloride vapour contained 26 bands and 11 lines. The relative intensities of lines and bands common to both spectra were not the same.

The oscillation frequencies of the bands seem to fall into series, but the heads are ill-defined. R. J. C.

Dispersion in the Electric Spectra of Benzene, Toluene, and Acetone. A. R. Colley (*J. Russ. Phys. Chem. Soc.*, 1908, **40** (*Phys.*), 228—244).—The author has investigated the electrical spectra of benzene, toluene, and acetone, a method being used which permits of accurate measurements with small troughs in the case of liquids with low refractive indices. The results, which are given in the form of tables and curves, bring out the intimate chemical relationship between toluene and benzene, two bands being common to the two spectra. Further, the spectra of toluene and acetone also exhibit one common band, which must be regarded as typical for the methyl group. T. H. P.

Discontinuous Cathode Luminescence Spectra of Some Aromatic Compounds. Otto Fischer (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 305—326. Compare Goldstein, Abstr., 1904, ii, 689, 690).—The emission spectra of the substances exposed to cathode rays at the temperature of solid carbon dioxide were photographed. Difficulties were found in certain cases, owing to the rapid change of colour of some substances under the influence of cathode rays. The ultraviolet spectra were not examined.

The number of luminous bands is with most aromatic substances considerable. In all the cases examined, the sharp edges of the bands are turned towards the red, the blue side being more or less indistinct. It is frequently possible to group the bands in series, corresponding pairs of which show a constant difference of wave-length.

In the case of naphthalene compounds, blue and violet light is only emitted for a short time, the colour changing to yellow or red. Three characteristic blue bands of naphthalene reappear in the spectra of all the naphthalene derivatives examined, and also in those of diphenyl and phenanthrene, but, whilst the last two compounds continue to emit these bands, the structure producing them is rapidly destroyed by the bombardment in the case of naphthalene derivatives. The same bands appear, strongly shifted towards the red, in anthracene and dibromoanthracene. C. H. D.

Influence of Temperature and of the State of Aggregation on the Absorption Spectra of Molten Salts. T. RETSCHINSKY (*Ann. Physik*, 1908, [iv], 27, 100—112).—An examination of the absorption spectra of some thirty molten inorganic salts has shown that, in all cases, there is a well-defined limit to the absorption band on the ultra-violet side of the spectrum, all radiations of smaller wave-length than that corresponding with the limiting value being completely absorbed. With rise of temperature, this limit is displaced in the direction of greater wave-lengths. When the displacement is expressed in terms of wave-lengths, its magnitude, for a given rise of temperature, increases with the wave-length; when expressed in terms of frequencies, the displacement is independent of the wave-length. For a temperature rise of 100°, the absorption limit is displaced to an extent represented by 10 to $20 \times 10^5/\mu\mu$.

Some of the salts have been also investigated in the solid state. The influence of temperature on the absorption limit is of the same order of magnitude as in the case of the molten substances. On liquefaction, the absorption limit is displaced considerably in the case of the chlorides and bromides of potassium and sodium, but no sharp change is met with in the case of silver nitrate, silver chloride, or lead chloride.

In regard to the influence of chemical composition on the absorption, it is found that the salts of the heavy metals absorb more than those of the alkali and alkaline-earth metals. In general, for a given metal the sulphate absorbs most light; then follow the chloride, bromide, iodide, and nitrate with gradually decreasing absorptions. For salts of the same acid containing metals belonging to the same group of the periodic system, the absorption limit is nearer the red end of the spectrum the greater the atomic weight of the metal.

H. M. D.

Fluorescence of Sodium Vapour. HANS ZICKENDRAHT (*Physikal. Zeitsch.*, 1908, 9, 593—603).—The thermal and electrical condition of fluorescing sodium vapour has been examined. In contact with air, fluorescence begins at 280—290°; this temperature is independent of the pressure, although the sharpness with which the phenomenon sets in is much greater at higher pressures than at low. Measurements have been made of the minimum potential required for electrical discharge through the vapour under different conditions. For sodium vapour in contact with air, the potential temperature curves show minima at 240° and 280°; the latter is supposed to correspond with the commencement of fluorescence. In contact with nitrogen and carbon dioxide, the minimum potential differences corresponding with this are 300° and 340° respectively. In contact with hydrogen, an olive-coloured fluorescence can be observed at 370°, but no current could be passed through the vapour with the available potential of 400 volts.

The properties of the vapour in contact with air have been examined in greater detail. Curves are plotted which show the dependence of the current on the discharge potential under different pressures, and also the dependence of the potential on the pressure and on the temperature for a given current intensity. When a current has been passed through the vapour for some time, a smaller potential is required for discharge immediately after the cessation of the current than when some time has elapsed. The potential gradually increases, and attains a constant value after some minutes. The paper concludes with a theoretical discussion of the cause of the conducting power of sodium vapour. H. M. D.

Fluorescence of Organic Substances. JOHANNES STARK and W. STEUBING (*Physikal. Zeitsch.*, 1908, **9**, 661—669. Compare Abstr., 1907, ii, 147, 417; this vol., ii, 138, 746).—Further observations relating to the fluorescence of substances containing chromophoric groups are communicated, and a summary is given of the results obtained in the series of papers published by Stark on the connexion between fluorescence and absorption.

The new substances examined were acetone, methyl ethyl ketone, pyrotartaric acid, phorone, diacetyl, camphor, camphorquinone, dimethylfulven, potassium azodicarboxylate, azodicarbonamide, diethylketen, and diphenylketen. From the observations, the conclusion is drawn that if a substance possesses two absorption bands, one in the region of longer wave-lengths, the other in the remote ultraviolet region, it will fluoresce in the region of the first band when light is absorbed in the region of the second. The fact that the maxima for the intensity of the fluorescence and absorption do not coincide is due to the absorption which the fluorescent light undergoes in its passage through the absorbing medium. The two azo-compounds investigated are exceptions to this general statement, but this is supposed to be due to the absence of the radiation of the requisite very short wave-lengths from the aluminium light used in the experiments. H. M. D.

Ultraviolet Fluorescence of Cyclic Compounds. HEINRICH LEY and K. VON ENGELHARDT (*Ber.*, 1908, **41**, 2988—2995. Compare Stark, Abstr., 1907, ii, 147; Stark and Meyer, *ibid.*, ii, 418).—The ultraviolet fluorescent, and the absorption, spectra of mono- and di-substituted benzene derivatives in ethyl-alcoholic solutions of N0·005 concentration have been measured in an apparatus very similar to that used by Stark; the results confirm this investigator's theory of the relation between fluorescence and selective absorption.

Toluene and propylbenzene are more strongly fluorescent than benzene, and the four bands which characterise the fluorescent spectrum of benzene have disappeared in the spectra of these two homologues. The auxochromic influence of the amino-group is accompanied by an auxofluoric influence, since aniline is more fluorescent than benzene; dimethylaniline, however, is less fluorescent than aniline, although the contrary might be expected from Kauffmann's view that the dimethylamino-group is a stronger auxochrome than the amino-group. The hydroxyl and the methoxyl groups also act as auxofluors, phenol and anisole exhibiting a remarkably strong fluorescence, whilst the very feeble fluorescence of benzoic acid is markedly increased in the hydroxybenzoic acids, of which the ortho-compound fluoresces most strongly, even in the visible region, as is evident to the naked eye, when a quartz lamp and a quartz vessel are used. Although anisole is more fluorescent than phenol, the methoxybenzoic acids are less so than the hydroxy-acids; the fluorescence of *p*-methoxybenzoic acid cannot be detected with certainty. The introduction of a halogen into the benzene nucleus diminishes the fluorescence, the more so the greater the molecular weight; iodobenzene does not fluoresce. Benzonitrile is remarkably fluorescent. Benzamide is non-fluorescent, showing that the amino-group only has auxofluoric influence when situated in the nucleus.

The presence of a nitro-group often entirely prevents fluorescence, even although *o*- and *p*-nitrophenols and *o*-nitroaniline exhibit marked selective absorption (according to Stark's theory, fluorescence is conditioned by the presence of bands in the absorption spectrum). The non-fluorescence may be attributable to quinonoid structure (compare Baly, Edwards, and Stewart, Trans., 1906, **89**, 514; Hantzsch, Abstr., 1906, i, 353), since simple quinones never fluoresce.

Neither pyridine nor ethyl collidinedicarboxylate exhibit fluorescence. Ethyl dihydrocollidinedicarboxylate, however, shows violet fluorescence in alcoholic solution, and also a very intense band; thus providing a good confirmation of Stark's theory. C. S.

Natural and Magnetic Rotation of the Plane of Polarisation in Crystals. WALDEMAR VOIGT and K. HONDA (*Physikal. Zeitsch.*, 1908, **9**, 585—590).—Measurements of the natural rotation of the plane of polarisation for a series of wave-lengths are recorded for *d*- and *l*-sodium chlorate and *d*-tartaric acid in the direction of the optic axis, and for sucrose in the direction of the two axes. The rotation induced by a strong magnetic field was measured for sodium chlorate, dolomite, apophyllite, apatite, and sucrose. In the case of sucrose, the values obtained for the two optic axes indicate that the magnitude of the rotation of the plane of polarisation is different in the two directions. H. M. D.

Relation between Rotatory Power and Chemical Constitution. II. D. HARDIN (*J. Chim. Phys.*, 1908, **6**, 584—591. Compare this vol., ii, 470).—The theoretical deductions given in the previous paper have been further tested by application to certain derivatives of hexyl alcohol.

The atomic product for oxygen (the product of the distance between the oxygen and carbon atoms and the atomic weight of the former element) is approximately the same as that calculated from observations on the amyl derivatives, but is of opposite sign. The difference of sign has not been satisfactorily accounted for.

The theory also indicates that the distance between the centre of gravity of the benzene ring and the first carbon in the side-chain will be different according as the bonds between carbon and hydrogen are in the plane of the ring or perpendicular to it. The experimental data obtained with hexylbenzene support the latter view as to the structure of the benzene nucleus.

Active hexyl alcohol (γ-methylamyl alcohol) was prepared by saponification of Roman camomile oil with cold concentrated potassium hydroxide solution and repeated fractionation. The fraction boiling at 151—152°/758 mm. has $D^{20\cdot5}$ 0·8262, $[\alpha]_D^{20\cdot5}$ +8·77°, D^{80} 0·7812, $[\alpha]_D^{80}$ 7·53°, and D^{147} 0·7276, $[\alpha]_D^{147}$ 6·10°. The corresponding *bromide* has D^{19} 1·1852, $[\alpha]_D^{19}$ +19·97°, D^{77} 1·1150, $[\alpha]_D^{77}$ 17·12°, and D^{142} 1·0319, $[\alpha]_D^{142}$ 13·97°. Active hexylbenzene (α-phenyl-γ-methylpentane) (compare Klages and Sautter, Abstr., 1904, i, 302), prepared by the action of sodium on a mixture of bromobenzene and hexyl bromide, has D^{19} 0·8521, $[\alpha]_D^{19}$ +16·62°, D^{105} 0·7873, $[\alpha]_D^{105}$ 14·99°, and D^{168} 0·7396, $[\alpha]_D^{168}$ 13·66°.

G. S.

Optical Isomerides. I. IWAN OSTROMISSLENSKY (*Ber.*, 1908, **41**, 3035—3046).—The observations of Gernez on the separation of a *dl*-conglomerate by means of the addition of a fragment of a substance isomorphous with one of the components have been extended.

The addition of *l*-asparagine to a supersaturated solution of *dl*-sodium ammonium tartrate causes the deposition of the pure *d*-tartrate.

Both *d*-tartrate and *l*-asparagine are hemihedral forms belonging to the rhombic system, and are isomorphous.

An optically active salt can also be obtained by impregnating a supersaturated solution of *dl*-sodium ammonium tartrate with a crystal of an active modification of any other alkali tartrate; for example, Rochelle salt, potassium tartrate, sodium tartrate, potassium hydrogen tartrate. In all cases the salt which is deposited is dextrorotatory if the impregnating material is dextro, and lævo if this is lævorotatory. Inoculation with ordinary ammonium malate causes the deposition of *d*-sodium ammonium tartrate. Substances which are isodimorphous with the sodium ammonium tartrate can also be used for bringing about the separation. Thus a crystal of *d*-potassium ammonium tartrate (usually monoclinic) causes the deposition of *d*-sodium ammonium tartrate, and similarly with potassium tartrate.

It is not necessary that the material used for inoculation should be optically active; thus glycine added to a supersaturated solution of *dl*-asparagine causes the deposition of either *d*- or *l*-asparagine, and it is not possible in any given experiment to predict which of the two will separate from an inspection of the glycine crystals, although the same glycine crystal always acts in the same way. The conclusion is drawn that glycine belongs to the hemihedral class of rhombic prisms.

This method of deposition is suggested as a method for determining whether the given substance is a *dl*-conglomerate or a *r*-compound.

If the crystals deposited on impregnating with an isomorphous substance are found to be inactive, then the original solution contained a racemic compound, but if active, then the original was an inactive conglomerate. J. J. S.

Chemical Action of Light. GIACOMO L. CIAMICIAN (*Bull. Soc chim.*, 1908, [iv], 3, i—xxvii).—A lecture delivered before the French Chemical Society. E. H.

Chemical Action of Tropical Sunlight. GILBERT JOHN FOWLER (*Mem. Manchester Phil. Soc.*, 1908, **52**, xiv, 1—20).—Observations are recorded on the rate of liberation of iodine from an acidified potassium iodide solution under the influence of light. The reaction is practically unaffected by temperature under the ordinary conditions of exposure. The rate of liberation of iodine from a given solution diminishes with the duration of the exposure; this is due to the absorption of the chemically-active rays by the iodine liberated previously. The initial rate of liberation diminishes with increasing dilution of the solution, but, on longer exposure, results in closer agreement are obtained, owing, no doubt, to the greater retarding effect of the iodine liberated from the stronger solutions.

Tables of data obtained by measurements made in Calcutta and on the Mediterranean and Arabian Seas are recorded. The highest record corresponds with an actinic effect which is forty-two times as great as the lowest record obtained on a bright December day in Manchester. No relationship appears to exist between the photochemical and the sun-stroke effect of sunlight.

Solutions of bleaching powder lose their available chlorine with great rapidity on exposure to tropical sunlight. The effect is much more marked in the case of dilute solutions than it is in strong solutions.

Silver chloride, sealed in a glass tube and darkened by exposure to light, becomes quite white again when kept for some time in the dark. In the presence of a globule of mercury, the original colour is not restored. These observations support the view that the darkening of silver chloride on exposure to light is a dissociation effect, and is not due to the formation of an oxychloride. H. M. D.

Photochemical Reactions. III. Decomposition of Ozone by Light. FRITZ WEIGERT (*Zeitsch. Electrochem.*, 1908, **14**, 591—597).—The decomposition of ozone by light in presence of chlorine (this vol., ii, 5) is studied quantitatively. The light of a mercury quartz lamp is used, and the rate of decomposition measured by means of the change of pressure of the gas. There is no induction period, and decomposition stops when the light is cut off. The rate of decomposition is independent of the concentration of the ozone; it increases with the concentration of the chlorine, but not in proportion to it, and it is nearly proportional to the intensity of the light. By placing a vessel containing chlorine between the source of light and the ozone tube, a measurement of the quantity of light absorbed by the chlorine is obtained; in this way it is shown that the rate of decomposition of the ozone is proportional to the quantity of light absorbed by the chlorine mixed with it. A rise of temperature of 10° increases the rate of reaction 1·17 times

It is suggested that the light produces some intermediate product which is destroyed rapidly by the action of ozone; the rate of decomposition measured is then the rate of formation of this product, which is independent of the concentration of the ozone. T. E.

Catalytic Reactions and Photochemical Equilibria. BARTOLO L. VANZETTI (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 285—288).—The author has carried out experiments to ascertain whether catalytic action necessitates immediate contact of the catalyst and the substance acted on, or whether the action can take place at a distance. When detonating gas is separated from platinum-black by a sheet of glass, the thickness of which is of the same order of magnitude as the wavelength of light, no combination occurs between the hydrogen and oxygen. But when the separating layer consists of an organic material, such as gelatin or a colloid, the hydrogen and oxygen combine slowly, but combination is found to be preceded by diffusion of the mixed gases through the membrane, as is shown by the observation that the diminution of the gas volume per unit of time is proportional to the concentration (pressure) of the gas mixture (compare Ernst, Abstr., 1901, ii, 495).

Experiments with platinum and platinum-black placed at a distance of 0·5—1 mm. from rapid bromide plates show that both these substances exert a negative action on the plate, that is, they take away the darkening produced in the sensitive emulsion by the action of light (compare Piltschikow, Abstr., 1906, ii, 414). This action is, however, quite different from that of light, and from the Russel effect produced by certain metals, in that it is only manifested at the surface of the photographic film and penetrates the latter only very slowly. This negative effect of platinum is especially marked in moist air, is greatly diminished in a cathode-ray vacuum, and is not exhibited in air in presence of phosphoric oxide. Experiments with other metals show that these may be arranged in the following series, in the first part of which the metals exhibit a diminishing positive effect on a photographic plate, whilst in the latter part an increasing negative effect is produced: cadmium, zinc, aluminium, lead, iron . . . copper, tin, silver, palladium, iridium, nickel, gold, platinum. If the condition in a silver bromide plate is represented as an equilibrium between the two reactions $3AgBr \rightleftarrows Ag_2Br + AgBr_2$, the upper of which is produced by the action of light, and the lower by the action of darkness, the action of platinum at a distance is to accelerate the latter change. T. H. P.

Chemical Changes Produced by Different Kinds of Rays. I. Catalytical Reactions of Sunlight. CARL NEUBERG (*Biochem. Zeitsch.*, 1908, 13, 305—320).—A large number of substances undergo chemical change when exposed in solution to sunlight in the presence of uranium salts. The following changes have been observed: Alcohols to aldehydes; poly-alcohols to hydroxy-aldehydes or ketones; acids to aldehydes or keto-compounds, sometimes with fewer carbon atoms than the original substance; monosaccharides to osones; disaccharides undergo inversion; polysaccharides and glucosides are hydrolysed; amino-acids undergo deamidisation and lose carbon dioxide, yielding aldehydes with a smaller number of carbon atoms than the original substance; glycerides are partly hydrolysed; peptones and proteins are partly hydrolysed, and the hydrolysis products undergo the fuller changes noted above.

Amongst the products actually isolated by decomposition in sunlight in presence of uranium salts were: glycerose in the form of the osazone, m. p. 130—131°, from glycerol; glyoxal in the form of the *p*-nitrophenylosazone from tartaric acid; acetaldehyde (in the form of the *p*-nitrophenylhydrazone) from alanine, from which ammonia was also obtained; dextrose (in the form of the osazone) from inulin.

S. B. S.

Theory of Coloured Salts. HERMANN FECHT (*Ber.*, 1908, **41**, 2983—2987).—The depth of the colour of many aromatic additive compounds appears to be conditioned by the magnitude of the difference of the electrical character of the two components; the more positive the one and the more negative the other, the deeper the colour. For example, quinone + phenol is red, quinone + sodium phenoxide is blue, and quinone + aniline in cold carbon disulphide yields a mass of dark violet crystals, which becomes colourless when the aniline is washed away. Again, diphenyldi-imine + benzidine gives a yellow solution, which becomes blue when the quinonoid component is made more negative by salt formation; the blue colour vanishes when the other component also enters into salt formation. Malachite-green becomes blue when chlorine is introduced into the phenyl group, and yellow when the halogen is attached to the still basic nitrogen atom. The effect on colour of the halogen atom or the hydroxyl or amino-group is not due to the influence of these *per se*, but depends on whether they increase or diminish the difference in the positive and negative characters of the components of the coloured substance.

When chlorine is passed into a solution of di-iododiphenyl in chloroform, yellow crystals of the *dichloride*, $C_{12}H_8I_2Cl_2$, m. p. 146° (decomp.), are obtained. By heating the dichloride with benzidine in chloroform or carbon disulphide, a *substance*, $C_{24}H_{20}N_2Cl_2I_2$, is obtained in the form of a violet-blue powder, which sublimes and decomposes at 300°.

Equal molecular quantities of quinone and benzidine in chloroform yield a mass of bluish-violet needles with a red, metallic lustre, which melt indefinitely at 118°, resolidify, and decompose above 200°.

The reaction between methyl glutarate and excess of magnesium phenyl bromide in ether leads to the formation of the *ketone*,

$$CPh_2{:}CH{\cdot}CH_2{\cdot}CH_2{\cdot}COPh,$$

m. p. 176°, which forms colourless crystals, and develops a bluish-green coloration with concentrated sulphuric acid. If the Grignard reagent is not in excess, the product of the reaction is the *ester*,

$$CPh_2{:}CH{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2Me,$$

m. p. 120°. C. S.

Rate of Decay of the Excited Radioactivity from the Atmosphere in Sydney. S. G. LUSBY and T. EWING (*J. Roy. Soc., New South Wales*, 1906, **40** 158—160).—A copper wire, 10 metres long, kept negatively charged at a potential of 25,000 volts, was after three hours' exposure rubbed with cotton wool moistened with ammonia. The cotton wool was incinerated, and the ashes tested for radioactivity; the time taken for the activity to fall to half value was on four days in December, 1905, found to be 41·5, 40·7, 41·9, and 39·5 minutes.

P. H.

Radioactivity of the Rocks in the Region Traversed by the Line to the Simplon. Gino Gallo (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 209—214).—The author has examined the radioactivity of various rocks excavated in the laying of the railway line to the Simplon. The limestone-gypsums and the rocks of the calcareous schist zone are either quite inactive or very feebly radioactive. With the orthogneisses, however, the chemical composition and coefficient of acidity of which indicate that they belong to the eruptive granitic magmas, moderately intense radioactivity is observed, the maximum value found being 43·2 volt-hours. The radioactivity is, in general, accompanied by the presence of certain minerals, such as titanite and zirconia. The pyrites minerals are also moderately radioactive, but the radioactivity cannot be definitely attributed to the metallic sulphides, and not to the gneissic gangue accompanying them. Borne (*Jahrb. Radioaktiv. Elektronik.*, 1905) has shown that, of the springs issuing from these rocks, those which are richest in emanation have their origin in the gneiss or in the granitic rocks.

T. H. P.

Preliminary Observations on Radioactivity and the Occurrence of Radium in Australian Minerals. D. Mawson and T. H. Laby (*J. Roy. Soc., New South Wales*, 1905, 38, 382—389).—A number of Australian minerals were examined for radioactivity by the ionisation produced in an air gap, the activity being compared with that of black oxide of uranium. Radium was tested for, and found in the case of two Australian minerals, but a gadolinite known to contain helium gave no radium emanation.

P. H.

Preparation of Radium from Pitchblende. Heinrich Paweck (*Zeitsch. Elektrochem.*, 1908, 14, 619—623).—A description of the process of manufacture of radium salts used at the radium works of the Austrian Government at St. Joachimsthal. The ores of Joachimsthal have been worked since 1518, first for silver, then for cobalt, nickel, arsenic, and bismuth, and more recently for uranium. In 1907 the extraction of radium from the residues from the uranium ore was begun. The raw ore is ground and washed to remove the lighter rock constituents, it is then roasted at 800° to remove sulphur, and finally heated again with sodium carbonate. Uranium, arsenic, antimony, tungsten, molybdenum, and vanadium are washed out in the form of sodium salts. From the residue, iron, aluminium, calcium, silicon, and lead are removed by boiling with sodium hydroxide and then with hydrochloric acid, very thorough washing following each operation. The residue contains barium and radium sulphates, which are converted into carbonates by repeated treatment with sodium carbonate and thorough washing, and then dissolved in hydrochloric acid and reprecipitated by sulphuric acid. This treatment is repeated several times. The solution of the chlorides is finally evaporated to dryness, and extracted with concentrated hydrochloric acid, which leaves a residue consisting mainly of barium and radium chlorides, which is submitted to fractional crystallisation. Of the radioactivity of the original ore, 73·9% is found in the residue from the uranium extraction, and the remainder in the solid uranium salts produced; there is no loss in waste products. T. E.

Quantitative Estimation of Radium Emanation in the Atmosphere. George C. Ashman (*Amer. J. Sci.*, 1908, [iv], **26**, 119—120).—The author has determined the radioactivity of 200 litres of Chicago air taken from the ground level. The purified air was passed through a long copper spiral immersed in liquid air to condense the emanation, which was afterwards volatilised into an electroscope and estimated. Precisely the same results were obtained in simultaneous estimations by this method, which is considered to be the best hitherto devised for the purpose.

The radium equivalent of the emanation per cubic metre of air was found to be 86, 58, and 45×10^{-12} gram in three experiments. Immediately after a thaw and heavy rain, the amount rose to 200×10^{-12} gram; under normal weather conditions with high barometer, the value 51×10^{-12} was found, whilst with a low barometer the amount was 131×10^{-12}.

The mean value, the equivalent of $1{\cdot}0 \times 10^{-10}$ gram of radium per cubic metre is 25% higher than the amount given by Eve. If the emanation has an appreciable vapour pressure at the temperature of liquid air, even the present estimate must be somewhat too low.

The active material had a half-period of decay of 3·5 days, indicating that it consisted only of radium emanation and that thorium emanation was absent. R. J. C.

Amount of Radium Emanation in the Atmosphere. John Satterly (*Phil. Mag.*, 1908, [vi], **16**, 584—615).—The amount of radium emanation present in the atmosphere of Cambridge has been measured by two methods. In the first, the emanation in a known volume of air was absorbed by charcoal; in the second, it was condensed by means of liquid air. The electrical conductivity imparted to a given volume of air by the absorbed or condensed emanation was then compared with the conducting power brought about by the emanation emitted from a definite volume of a radium solution of known strength. The results of the two methods of measurement, which agree fairly well, show that the amount of radium emanation in the atmosphere varies very considerably. On the average, the quantity contained in a cubic metre of air is equal to the amount which would be in radioactive equilibrium with about 1×10^{-10} gram of radium. No connexion between the variation in the concentration of the emanation and the meteorological conditions could be detected. The observed values indicate that only a small proportion of the natural ionisation of the air is due to the presence of the radium emanation and its products. H. M. D.

Amount of Radium Emanation in the Atmosphere near the Earth's Surface. A. S. Eve (*Phil. Mag.*, 1908, [vi], 16, 622—632. Compare this vol., ii, 7).—Experiments according to the method already described have been continued at intervals for almost a year. An error in the previous calculations is pointed out, and this is corrected in the evaluation of the new experimental data.

The average amount of emanation present in a cubic metre of the air of Montreal during the period of the experiments is that which would be in equilibrium with 60×10^{-12} gram of radium. The observed variation in the concentration of the emanation is such that the maximum is to the minimum as 7 is to 1. Changes of temperature have little or no influence on the concentration of the emanation, but it increases on the approach of a deep cyclone accompanied by heavy rain or a thaw of snow, and decreases with anticyclonic conditions when the weather is dry or very cold. H. M. D.

The Heat Developed by Radium. Egon von Schweidler and V. F. Hess (*Monatsh.*, 1908, 29, 853—862).—A quantity of over 1 gram of radium chloride was used for the experiments. A differential calorimeter was used consisting of two gilt-copper vessels in a chamber at constant temperature. One vessel contained the radium, and the other was heated by means of an electric current. Two copper-nickel thermo-junctions were balanced against one another, the heating current being adjusted until the temperatures were equal.

The results indicate a heat development of 118·0 cal. per hour for 1 gram of metallic radium, with a possible error of 1·4%. This is in good agreement with the value, 117 cal., obtained by Ångström (Abstr., 1906, ii, 63). C. H. D.

Relation between Uranium and Radium. III. Frederick Soddy (*Phil. Mag.*, 1908, [vi], 16, 632—638).—A further examination of the carefully-purified uranium salts prepared in 1905–06 has been made to ascertain the rate of production of radium (compare Soddy and Mackenzie, Abstr., 1907, ii, 730). In one case, the growth of radium is not greater than 5×10^{-11} gram per kilo. of uranium in $2\frac{3}{4}$ years, and in the other, it is not greater than 1×10^{-11} per gram kilo. of uranium in $1\frac{2}{3}$ years.

An examination of the residues from the highly-purified uranium salts has shown that the amount of radium present has increased about seven times during a period of one year. This indicates that a radium-producing substance is present in commercial uranium salts. Further, since the residues had been purified by the barium sulphate method with the object of removing radium and any intermediate products in the transformation of uranium into radium, it is established that the barium sulphate purification process does not remove the whole of this radium-producing substance. H. M. D.

Radiation of Uranium *X*. Max Levin (*Physikal. Zeitsch.*, 1908, 9, 655—657. Compare Abstr., 1907, ii, 836).—As the distance between the radiating substance and the ionisation chamber is diminished, the ionisation produced by uranium *X* slowly increases at first, attains a maximum value, and then rapidly diminishes. If the active substance is covered with a thin layer of aluminium, there is no evidence of this maximum ionisation value. The following explanation of the observed maximum in the case of the uncovered substance is given. As the distance between the source and the ionisation chamber increases, the actual number of ions which are discharged increases. When this distance is considerable, the strength of the electric field is not sufficient to bring about the discharge of all the ions before reunion takes place. If the ionisation per centimetre were constant, this should lead to a constant limiting ionisation when the distance is sufficiently great, but the fact that the strongly ionised layer in the immediate neighbourhood of the active substance is gradually removed from the measuring chamber influences the ionisation in such a way that, although an increase takes place at first with increasing separation, this is more than compensated for by the second effect when the distance has attained a certain value. H. M. D.

Actinium *C*, a New Short-lived Product of Actinium. Otto Hahn and Lise Meitner (*Physikal. Zeitsch.*, 1908, 9, 649—655).—Measurements of the ionisation produced by the α- and β-radiation emitted by the induced activity of actinium indicate that this consists of three disintegration products: actinium *A*, *B*, and *C*. Actinium *C* was separated from *A* by the action of finely-divided metals and animal charcoal on a solution of the active deposit, and its period of decay was found to be 5·10 minutes. It emits no α-rays, but the β-rays previously attributed to actinium *B* are found to be due to actinium *C*. The α-rays given off by the active deposit are entirely due to actinium *B*, whilst actinium *A* only emits a very readily absorbed type of β-radiation. In agreement with Bronson's determination, the decay period of actinium *B* is found to be 2·15 minutes, and that of actinium *A*, thirty-six minutes. These two products can be separated by heating the active deposit for about thirty seconds in a blow-pipe flame; the separation is not, however, complete even when the temperature is raised to 2000°.

Equations are given which represent the change in the α- and β-activity of the active deposit in agreement with the experimental observations. H. M. D.

Range of Activity and Absorption of α-Rays. Secondary Radiation Produced by α-Rays. E. Aschkinass (*Ann. Physik*, 1908, [iv], 27, 377—390).—An apparatus is described by means of which the charge on α-particles from polonium could be measured after passing through aluminium foil in a high vacuum. A magnetic field was employed to remove electrons and secondary radiation.

As found by other workers, layers of aluminium foil up to 13·7μ in thickness allow the whole of the α-particles to pass. At about 24μ, the particles are completely arrested. It is probable that complete absorption occurs suddenly at a definite thickness of aluminium.

Experiments with the same apparatus in the absence of a magnetic field indicate that the negative radiation from polonium considerably exceeds the positive in quantity. The secondary radiation produced by the α-particles may also be studied by its means. C. H. D.

Ionisation of Gases by α-Rays, and the Hypothesis of Initial Recombination of the Ions. M. MOULIN (*Chem. Zentr.*, 1908, ii, 474—475; from *Le Radium*, 1908, 5, 136—141. Compare Abstr., 1906, ii, 720).—The hypotheses of Bragg and Kleeman, and Langevin, as explanatory of the unsaturation of an electric current at low *E.M.F.* when passed through a gas ionised by α-rays, have been tested by the author. The evidence so far obtained appears to support Langevin's view, that the α-rays produce a larger number of ions, which, however, become arranged along the path of the α-rays.

J. V. E.

Quality of the Secondary Ionisation due to β-Rays. WILLIAM H. BRAGG and J. P. V. MADSEN (*Phil. Mag.*, 1908, [vi], 16, 692—697).—Experiments are described which show that the secondary rays reflected by different substances struck by the same bundle of primary rays are not uniform in quality, but vary from one substance to another. For the purpose of collecting all the secondary rays, the authors have made use of an ionisation chamber with a hemispherical wall.

It is found that the secondary rays returned by substances of low atomic weight contain a relatively large proportion of less penetrating rays. When the less penetrating portions of the primary beam are cut off, the emitted secondary rays are found to be more penetrating. On account of these facts, observations of secondary radiation cannot be accurately made when ionisation vessels of the ordinary type are employed.

H. M. D.

Attempts to Detect the Production of Helium from the Primary Radio-elements. FREDERICK SODDY (*Phil. Mag.*, 1908, [vi], 16, 513—530).—Experiments have been made to obtain a quantitative estimate of the amount of helium produced from uranium and thorium. By the process recently described (Abstr., 1907, ii, 251), it is possible to detect 2×10^{-10} gram of helium by observation of the D_3 line. In an experiment in which 350 grams of thorium in the form of nitrate were employed, helium to the extent of about 2×10^{-10} gram was detected after a period of accumulation of nearly seven months. This corresponds with a rate of production of 2×10^{-12} per year. The two estimated rates of production, on the assumption that the helium atom is identical with an α-particle, are, according to two different methods, 2×10^{-12} and $4{\cdot}5 \times 10^{-12}$. It may be pointed out that the former value is almost eight times less than the value calculated three years ago.

H. M. D.

Rate of Production of Helium from Radium. Sir JAMES DEWAR (*Proc. Roy. Soc.*, 1908, 81, *A*, 280—286).—The rate of production of helium from radium was determined directly by observing the growth of pressure in a McLeod gauge connected with a vessel containing 70 mg. of radium chloride. A small tube containing cocoanut charcoal was sealed on to the gauge; the tube was kept in liquid air during an experiment, and served to condense any gases, other than helium or hydrogen, which might be generated in, or leak into, the apparatus. Before starting an experiment, the apparatus was exhausted, first with a mercury pump, then with a large bulb containing charcoal immersed in liquid air, which was sealed off after some hours, and, finally, to a pressure of 0·00005 mm. by cooling the small charcoal bulb.

The second and more satisfactory experiment lasted 1100 hours. At intervals, the radium was heated to low redness, causing an increase of pressure after cooling to room temperature, which remained steady, showing that part of the helium had been occluded by the radium. Direct experiment showed that the helium was not appreciably occluded by the charcoal. It was further shown by examination of the spectrum, and by two other independent methods, that the helium was not contaminated with hydrogen.

A mean line drawn through the observations with the radium heated, shows a steadily maintained helium increment of approximately 0·37 c.mm. per gram of radium per day, a result which agrees almost exactly with that calculated by Rutherford on the assumption that the α-particle is an atom of helium carrying two ionic charges. On the other hand, Ramsay and Cameron (Trans., 1907, **91**, 1274) have determined the rate of production of the emanation from radium, the ratio of the amount of helium to that of the emanation being found by them to be 3·18; their value is about eight times as great as that of the author. It is pointed out in a footnote that Rutherford's experimental determination of the rate of production of the emanation gives a value about one-tenth that obtained by Ramsay, but in good agreement with the present results, on the assumption that the ratio of helium to emanation is 3 : 1. G. S.

Accumulation of Helium in Geological Time. Robert J. Strutt (*Proc. Roy. Soc.*, 1908, **81**, *A*, 272—277).—The experiments were undertaken in order to obtain a comparison of the helium content of minerals with their geological age. It was found that phosphatic nodules and phosphatised bones, occurring in such strata that their relative age was well defined, possessed a radioactivity much higher than that of rocks, and that the activity was connected with the presence of uranium minerals.

The helium was liberated by dissolving the minerals in acids, and separated from other gases by special methods. The radium content of the minerals was determined in the usual way, and from the results the percentage of uranium oxide calculated by comparison with a standard uranium mineral.

The ratio of helium to uranium oxide is not strictly proportional to the age of the strata, but high ratios are not found in the younger strata, whereas they are common in the older ones. The absence of direct proportionality is ascribed to imperfect retention of the helium.

From the results, on the basis of Rutherford's estimate of the rate of production of helium from radium, an attempt is made to calculate the age of the strata. The following are provisional *minimum* values:

Phosphatic nodules of the crag, 225,000 years; of the upper greensand, 3,080,000 years; of the lower greensand, 3,950,000 years; and hæmatite overlying carboniferous limestone, 141,000,000 years.

G. S.

Helium in Saline Minerals, and its probable Connexion with Potassium. ROBERT J. STRUTT (*Proc. Roy. Soc.*, 1908, **81**, *A*, 278—279).—The ratio of helium to uranium oxide has been determined (as described in the previous abstract) for the Stassfurt minerals, sylvine, carnallite, kieserite, and rock salt, and a number of other minerals from the same source have been examined qualitatively. Only for sylvine and carnallite is the ratio so high that it cannot be accounted for by the uranium present, and it is suggested that potassium may be the source of the helium in these two minerals (compare Campbell and Wood, Abstr., 1907, ii, 217; McLennan and Kennedy, this vol., ii, 750).

G. S.

Electrical Conductivity of Alloys and their Temperature-coefficients. ERNST RUDOLFI (*Physikal. Zeitsch.*, 1908, **9**, 607—609).—Polemical against Guertler (compare this vol., ii, 557).

H. M. D.

Conductivity of Fused Salts. KURT ARNDT and ALBERT GESSLER (*Zeitsch. Elektrochem.*, 1908, **14**, 662—665).—The conductivities of a number of salts are measured by the method described by Arndt (Abstr., 1906, ii, 418). The results (in reciprocal ohms per cm.) are:

	450°	500°	550°	600°	650°	700°	750°	800°	850°	900°	950°	1000°	1050°	1100°
$CaCl_2$	—	—	—	—	—	—	—	1·90	2·12	2·32	2·50	2·66	2·76	—
KCl	—	—	—	—	—	—	—	2·19	2·30	2·40	2·50	2·61	—	—
KBr	—	—	—	—	—	—	1·65	1·75	1·85	1·95	2·05	—	—	—
KI	—	—	—	—	—	1·39	1·51	1·64	—	—	—	—	—	—
NaBr	—	—	—	—	—	—	—	3·06	3·23	3·30	—	—	—	—
NaI	—	—	—	—	—	2·56	2·63	2·70	2·76	2·83	2·90	—	—	—
AgCl	—	—	4·34	4·48	4·62	4·76	—	4·98	—	5·14	—	—	—	—
AgBr	2·93	3·02	3·10	3·18	—	3 34	—	3·50	—	3·68	—	—	—	—
AgI	—	—	2·46	2·52	2·59	2·64	—	2·72	—	—	—	—	—	—
$NaPO_3$	—	—	—	0·30	0·425	0·55	0·675	0·80	0·925	1·05	1·175	1·30	1·42	1·54
B_2O_3	—	—	—	—	—	—	—	(0·7	1·2	2·1	3·3	4·6	$\times 10^{-5}$)	

The conductivity is in all cases a linear function of the temperature; for the alkali salts it is approximately proportional to the absolute temperature. The conductivities of mixtures of potassium and sodium chlorides and of calcium and strontium chlorides are very nearly the mean of those of the constituents.

T. E.

Density and Equivalent Conductivity of Some Fused Salts. KURT ARNDT and ALBERT GESSLER (*Zeitsch. Elektrochem.*, 1908, **14**, 665—667).—The density is determined by means of a platinum sinker and Westphal balance. The results are (in grams per c.c.):

	850°	900°	950°	1000°	1050°
$CaCl_2$ ……………	2·03	2·01	1·99	1·97	—
$SrCl_2$ ……………	—	2·69	2·67	2·645	2·62
$BaCl_2$ ……………	—	—	—	3·12	3·09

For mixtures of calcium and strontium chlorides, the densities found are slightly smaller than the mean:

	700°	800°	900°	1000°	1100°
$NaPO_3$ …………	2·22	2·18	2·14	2·10	—
B_2O_3 ………… …	—	—	1·520	1·508	1·495

Mixtures of sodium metaphosphate and boron trioxide were measured at 900°; very considerable contraction occurs. In the following table, x is the percentage of sodium metaphosphate:

x …………	50	25	10	5	1·0	0·5
Density …	2·115	1·820	1·655	1·585	1·552	1·522

The equivalent conductivities are calculated by means of the figures in the preceding abstract. T. E.

Limiting Conductivity of Some Electrolytes in Ethyl Alcohol. PAUL DUTOIT and H. RAPPEPORT (*J. Chim. Phys.*, 1908, 6, 545—551).—The alcohol used in the measurements had a specific conductivity of the order 10^{-7} reciprocal ohms. The values of the limiting molecular conductivity, μ_∞, were obtained directly by measurements in very dilute solution (up to a dilution of 20,000 litres) and indirectly by extrapolation from measurements in more concentrated solutions. The values of μ_∞ at 18°, expressed in Siemens units, are 39·2, 39·1, 35·8, and 35·0 respectively for the iodides of potassium, sodium, lithium, and ammonium, and 41·1 and 38·0 for the thiocyanates of potassium and ammonium respectively. Ammonium bromide gives 36·4, and sodium acetate, 31·8.

Kohlrausch's law holds for the electrolytes examined within the limits of experimental error, but the dilution law does not apply.

The order of the speed of the ions is the same in water and in alcohol, but the ratio of the speeds in the two solvents is by no means constant, varying from 1·8—3 : 1. G. S.

A Light Accumulator. R. GOLDSCHMIDT (*Bull. Soc. chim. Belg.*, 1908, 22, 317—327).—An accumulator in which the electrodes are zinc and oxide of nickel, and the electrolyte a concentrated solution of potassium carbonate, is described. The changes taking place on charging and discharging are represented by the upper and lower arrows respectively in the equation $Ni_2O_3 + 2Zn \rightleftarrows NiO + 2ZnO$, the electrolyte taking no direct part in the reaction. The nickel peroxide electrodes are prepared by electrolysis of a solution of nickel silicofluoride containing a little cobalt silicofluoride, nickel plates being used as anode, and the nickel deposited on a sheet of iron covered with nickel serving as cathode. A constant *E.M.F.* of about 2·75 volts is employed. After seven to eight hours' electrolysis, it is necessary to add a little cobalt silicofluoride and free hydrofluosilicic acid to the electrolyte to prevent the formation of a green mass on the cathode. The plate thus prepared is washed and oxidised electrolytically in a solution of sodium carbonate.

The zinc electrodes are prepared by electrolysis of a strong solution of zinc silicofluoride containing a little free acid, zinc plates being used as anode, and the zinc deposited on iron as cathode. It is remarkable that much better deposits of zinc are obtained after the electrolyte has been in use for some time.

The plates thus prepared are immersed in a 43% solution of potassium carbonate or a 25% solution of sodium carbonate to form an accumulator; the potassium salt is preferable. An accumulator of this type has a capacity of at least 60 ampere-hours per kilo. of positive electrode; with a current of 15—20 amperes, the yield is about 100 watts, and the mean *E.M.F.*, 1·57 volts. It has the further advantage that it can be charged with a very large current, up to 50 amperes per kilo. of positive electrode, without damage. G. S.

Formation of Gas in Discharge Tubes. Rudolf von Hirsch (*Physikal. Zeitsch.*, 1908, **9**, 603—606. Compare Hirsch and Soddy, this vol., ii, 12).—The author has investigated the gas which is evolved from aluminium electrodes containing sodium as an impurity when cathode rays are generated by means of an influence machine. About 50% of the gas is absorbed by glowing copper oxide, and consists of hydrogen. The remainder appears to be carbon dioxide, for the spectral bands of this gas become much stronger after the removal of the hydrogen. This mixture of gases differs from others previously examined in that the product p^2V is constant, p being the gas pressure and V the discharge potential. It has been suggested previously (*loc. cit.*) that the constancy of p^2V is characteristic of pure gases, and this has led to a detailed examination of mixtures of hydrogen and carbon dioxide.

The value of p^2V for pure carbon dioxide is about 1/22 of that for hydrogen; the connexion between the value of the product and the molecular weight of the gas does not hold therefore in this case. For mixtures of the two gases, p^2V is not constant; the curve, which represents the deviations of the product from a constant value, exhibits maxima for mixtures containing a large excess of one or the other gas, and a minimum for which $p^2V=4$.

Analysis of two mixtures giving this minimum value showed that approximately equal quantities of the two gases are present. This mixture is the one produced from the aluminium electrodes, the constancy of the proportions between the two gases being maintained automatically. The formation of the gases is due to the action of water and carbon dioxide on the sodium contained in the aluminium. H. M. D.

Chemical or Physical Theory of Volatilisation (of Cathodes). Franz Fischer and Otto Hähnel (*Zeitsch. Elektrochem.*, 1908, **14**, 677—681). Volkmar Kohlschütter (*ibid.*, 681—683).—Fischer and Hähnel regard the volatilisation as a purely physical phenomenon; Kohlschütter upholds his chemical hypothesis (this vol., ii, 457, 653, 799, and 800). T. E.

Volatilisation of Cathodes in Attenuated Gases. B. Walter (*Zeitsch. Elektrochem.*, 1908, **14**, 695).—In Fischer and Hähnel's experiments (this vol., ii, 653), the current passing in the argon and hydrogen tubes is the same, but the energy consumed is greater in hydrogen; hence for equal quantities of energy the volatilisation would be greater in argon. T. E.

Behaviour of Calcium and Sodium Amalgams as Electrodes in Solutions of Neutral Salts. HORACE G. BYERS (*J. Amer. Chem. Soc.*, 1908, **30**, 1584—1586).—Le Blanc and Novotný (Abstr., 1907, ii, 22) found that the values of the equilibrium constant of the reaction between sodium carbonate and calcium hydroxide, obtained by direct determination, did not agree with those calculated from the solubilities of calcium hydroxide and calcium carbonate. An attempt has therefore been made to determine this constant by measuring the *E.M.F.* of the cell $CaHg-CaCO_3-Na_2CO_3 \mid NaOH-Ca(OH)_2-CaHg$, K being calculated from the equation $\pi = RT/7 \times lnK/a$. The value of π, however, could not be satisfactorily determined, owing to the rapid action of water on the calcium amalgam, but interesting results were obtained on the action of solutions of salts on the amalgam. Similar experiments were made with sodium amalgam and solutions of salts. The results are tabulated.

It has been found that when amalgams are treated with solutions of salts of alkali or alkaline-earth metals, replacement occurs, and the determination becomes that of the *E.M.F.* of an electrode consisting partly of the amalgam of the metal of the added solution. Replacements of this character in concentrated amalgams have been recorded previously. E. G.

Anomaly of the Strong Univalent Electrolytes M. KATAYAMA (*J. Coll. Sci Tōkyō*, 1908, **25**, vii, 1—42).—By combining the views of Nernst (Abstr., 1901, ii, 647) and Jahn (Abstr., 1900, ii, 522; 1901, ii, 491; 1902, ii, 597) with those of Storch (Abstr., 1896, ii, 288) and Bancroft (Abstr., 1900, ii, 186), the author has deduced the following empirical formula:

$$K = \frac{c_i^n}{c_n}\left(\frac{c_i}{c_n}\right)^{-0\cdot3\frac{c_i^2}{c_n}},$$

that is, $\log K = n \log\frac{\lambda}{\lambda_\infty}c - \log\frac{\lambda_\infty - \lambda}{\lambda_\infty}c - 0\cdot3\frac{\lambda^2 c}{(\lambda_\infty - \lambda)\lambda_\infty}\log\frac{\lambda}{\lambda_\infty - \lambda}$, where K is a constant, c_i the concentration of the ions in gram-mols per litre, c_n the concentration of the neutral, undissociated molecules, $c_i + c_n = c$ the total concentration, n a constant, λ the equivalent conductivity for the concentration c, and λ_∞ the equivalent conductivity for infinite dilution. The values obtained with this formula are in close agreement with the observed conductivities for every kind of univalent electrolyte.

In conjunction with Nernst's theory of solutions (*loc. cit.*), the following assumptions were made: $\pi_1 = a_1 c_n c_i^s$; $\pi_2 = a_2 c_i\left(\frac{c_i}{c_n}\right)^{0\cdot3\frac{c_i^2}{c_n}}$; where π_1 is the vapour pressure of the neutral molecule, π_2 the vapour pressure of the cation or anion, and a_1, a_2, and s are constants. The values for the *E.M.F.* calculated on the second assumption are in fair agreement with the observed values. The partition-coefficient values obtained by Rothmund and Drucker for picric acid (Abstr., 1904, ii, 231) are well explained with the aid of the first assumption. By combining the two, it is possible to calculate the lowering of the freezing point of an aqueous solution of a strong electrolyte, which as a rule is in agreement with the observed depression. W. H. G.

The Size of Molecules and Charge of the Electron. JEAN PERRIN (*Compt. rend.*, 1908, **147**, 594—596).—The number (N) of molecules in a gram-molecule, the charge (e) of the electron, and the ratio (a) of the mean energy of a molecule to its absolute temperature are universal constants, all of which are known when the value of one is determined, since (1) in the electrolysis of a univalent salt 96550 coulombs are conveyed by N atoms, whence $Ne = 3 \times 10^9 \times 96550$ electrostatic units; (2) the kinetic energy of a gram-molecule is measured by $3RT$, so that $2Na = 3R = 3 \times 83{\cdot}2 \times 10^6$.

The values 3×10^{-10} (Townsend), $3{\cdot}4 \times 10^{-10}$ (J. J. Thomson), $6{\cdot}8 \times 10^{-10}$ (J. J. Thomson), and $3{\cdot}1 \times 10^{-10}$ (H. A. Wilson) have been found for e, and from them values varying from 43×10^{22} to 96×10^{22} derived for N. Planck has obtained the value $2{\cdot}02 \times 10^{-16}$ for a and deduced 61×10^{22} for N, but Lorentz from the same data finds $N = 77 \times 10^{22}$. The author has determined N by a method based on the assumption that equal particles distribute themselves in a dilute emulsion in the same manner as molecules of the same mass which obey the gas laws. This leads to the equation $2{\cdot}3 \log_{10} n_0/n = N/RT[4/3\pi a^3 g(d-\sigma)h]$, in which n and n_0 signify the concentrations of the particles at levels separated by the distance h, a the radius of the particles, and $(d-\sigma)$ the excess of their density over that of water. After finding that particles of very different size gave the same value for N, the value 71×10^{-22} was obtained, and the values $4{\cdot}1 \times 10^{-10}$ and $1{\cdot}7 \times 10^{-16}$ thereby deduced for e and a respectively. From this value of N, the mass of the oxygen molecule is $0{\cdot}45 \times 10^{-22}$ gram, of the hydrogen atom $1{\cdot}40 \times 10^{-24}$ gram, and of the *corpuscule* $0{\cdot}75 \times 10^{-27}$ gram. E. H.

Magnetic Susceptibility of Solutions. P. PASCAL (*Compt. rend.*, 1908, **147**, 242—244. Compare this vol., ii, 756).—The rule that a magnetic atom becomes more diamagnetic the more it enters into complex ions or colloidal molecules, and becomes removed from its characteristic chemical properties, has been verified in the cases of certain ferrous, cobalt, chromium, copper, and mercury salts. Ferropyrophosphates, ferro-oxalates, and ferrometaphosphates are oxidised at rates which are in order of their magnetism. The decrease of magnetism on adding sodium carbonate to these salts is accompanied by a slower rate of oxidation. R. J. C.

Relation of Melting Point to the Surface of the Granules of a Solid Substance. P. N. PAWLOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1022—1066).—From theoretical considerations, the author shows that the relation between the melting point, T, of a substance and the radius, r, of its granules is expressed by the following differential equation:

$$dT/dr = [A(v_2 - v_1)p.2k/r^2.dR\sigma]/[\rho + A(v_2 - v_1)p.2k/r.dR\sigma T],$$

where A is a constant independent of the magnitude of the granules for any given temperature, and is given by the expression: $\log Ap = 2k/rdR\sigma T$; k is the surface tension at the separation of the solid from vapour; r the radius of the spherical granules; σ the specific volume of the vapour; ρ the specific heat of liquefaction; v_2 and v_1 the volumes of unit masses of the liquid and solid respectively at the melting point.

Granules of commercial salol having a magnitude of 8μ melt 3·5° lower than those 32μ in size. After one recrystallisation, granules of 6μ—40μ melt within an interval of 1·5°. Dust having dimensions less than 2μ melts, in the case of salol 7°, with antipyrine 5—7°, and with phenacetin 4°, lower than large granules of diameter 0·5—2 mm.

T. H. P.

Apparatus for Determining the Freezing Point of Mixtures. OTTO SCHEUER (*J. Chim. Phys.*, 1908, 6, 620—624).—Two forms of apparatus suitable for determining the freezing point of mixtures are described. The first is a modified Beckmann apparatus. The essential feature of the second is that the stirring is concentric, and is effected by means of the thermometer, to the lower part of which two strips are attached for this purpose.

G. S.

Negative Adsorption. REGINALD O. HERZOG (*Zeitsch. physiol. Chem.*, 1908, 57, 315—316).—Tezner and Roske state (this vol., ii, 810) that negative adsorption does not occur. This, however, is only true when the adsorption of a single substance is dealt with, and instances are given where, under other conditions, the phenomenon does take place.

W. D. H.

The Fusion Curves of the System Naphthalene–Phenol. T. YAMAMOTO (*J. Coll. Sci. Tōkyō*, 1908, 25, xi, 1—23).—The freezing-point curve of mixtures of naphthalene and phenol was determined by the cryoscopic method, a correction being made for supercooling. The eutectic point lies at 29·7° and 15·7 mol. % naphthalene. The form of the phenol curve is explained as being due to the association of phenol in the liquid state, represented by the equilibrium $3C_6H_6O \rightleftharpoons (C_6H_6O)_3$. The equilibrium constant of this association is expressed as a function of temperature, the heat of association being also determined.

C. H. D.

The Fusion Surfaces of the System Naphthalene–Chlorobenzene–Phenol, and the Molecular Association of Phenol. H. HIROBE (*J. Coll. Sci. Tōkyō*, 1908, 25, xii, 1—50. Compare preceding abstract).—The fusion surfaces (freezing-point surfaces) of naphthalene and phenol in the ternary system have been determined, an accurate cryoscopic method being employed. The two surfaces are separated by a eutectic curve, the projection of which on the plane of composition is nearly a straight line. The form of the surfaces is consistent with the assumption that naphthalene and chlorobenzene are non-associated, and that phenol is partly associated to triple molecules. The latter conclusion was supported by determinations of the partition-coefficient of phenol between chlorobenzene and an aqueous solution of sodium chloride and sodium sulphate. C. H. D.

Arrangement for Liquefying and Distilling Easily Condensible Gases and Low-boiling Liquids. Aurel von Bartal (*Chem. Zeit.*, 1908, **32**, 891).—A U-shaped form of receiver which can be completely immersed in a freezing mixture contained in a vessel consisting of two concentric cylinders between which there is a layer of asbestos; in this way, a very effective condensation is ensured. When removed from the freezing mixture, the apparatus can be employed as a distillation flask by gently warming it; the distillate may be condensed in a second similar apparatus cooled in a freezing mixture. P. H.

Practical Studies in Vacuum Sublimation. Richard Kempf (*J. pr. Chem.*, 1908, [ii], **78**, 201—259).—The employment of sublimation in a vacuum as a means of purification entails a smaller loss of substance than does recrystallisation, whilst, on the other hand, in consequence of the slower volatilisation, a more complete separation of a mixture is secured than by fractional distillation. The author describes an arrangement for sublimation experiments suitable for use in a laboratory, consisting of a glass tube on to one end of which is ground a glass cap with a tap and nozzle for connecting with the pump, and on to the other a bent pear-shaped glass bulb. This bulb, containing the substance to be sublimed, is heated in a suitable air-oven; the straight tube projecting through a hole in the side of the oven serves as the receiver for the sublimate. The phenomena of sublimation are discussed, and details given of experiments with fifty-three inorganic and organic compounds. G. Y.

Heat of Combination of Acidic Oxides with Sodium Oxide and Heat of Oxidation of Chromium. William G. Mixter (*Amer. J. Sci.*, 1908, [iv], **26**, 125—137. Compare Abstr., 1907, ii, 738).—The heats of formation of sodium orthoborate, aluminate, chromate, and tungstate have been determined by firing mixtures of sodium peroxide with the metals or with metallic oxides in presence of carbon. Incidentally, the heats of formation of chromium sesquioxide and trioxide were calculated. Since the salts in question are largely hydrolysed by water, previous determinations by Thomsen, Berthelot, and others which referred to solutions are regarded as less trustworthy than those obtained by the sodium peroxide method. The heat of formation of sodium sulphate, on the other hand, is found to be the same by both methods. The principal results obtained were:

$3Na_2O + B_2O_3 = 2Na_3BO_3$ .... + 104,200 cal.
$Na_2O + Al_2O_3$(amorphous) $= 2NaAlO_2$ + 40,000 ,,
$Na_2O + CrO_3 = Na_2CrO_4$ .... + 77,000 ,,
$Na_2O + WO_3 = Na_2WO_4$ .... + 94,700 ,,
$Cr + 3O = CrO_3$ .... + 140,000 ,,
$2Cr + 3O = Cr_2O_3$(amorphous) .... + 243,800 ,,

The heats of transformation of aluminium and chromium oxides from the amorphous to the crystalline state were also determined.

During the combustions which were made in a silver bomb, or a silver cup suspended in a steel bomb, a small amount of oxygen was always liberated, for which a correction was necessary. R. J. C.

Viscosity of Certain Metals and its Variation with Temperature. CHARLES E. GUYE and S. MINTZ (*Arch. sci. phys. nat.*, 1908, **26**, 136—166, 263—278).—From observations on the rate of decrease of the amplitude of vibration of loaded wires when twisted, the authors have compared the viscosity of platinum, silver, gold, copper, and steel at different temperatures. To eliminate the damping effect of the air, the vibrating wire was enclosed in an apparatus which could be exhausted.

The viscosity increases with the temperature in the case of platinum, silver, gold, and copper, and the curves which express the relationship between the two factors are of the same type. In the case of steel, the viscosity increases up to about 100°, then falls, and passes through a minimum value at about 200°, above which it increases very rapidly. This phenomenon can be observed both with rising and falling temperatures, indicating that it is due to reversible changes.

The influence of temperature on the viscosity is diminished by previous annealing; it increases when the load on the wire is increased. H. M. D.

Viscosity of Dilute Alcoholic Solutions. TOSHIO HIRATA (*J. Coll. Sci. Tōkyō*, 1908, **25**, v, 1—15).—Arrhenius has shown (Abstr., 1880, 336) that the viscosity of an aqueous solution of any two indifferent substances may be expressed by the formula $z = A^x B^y$, where A and B are two constants characteristic of the two solutes at a constant temperature, x and y being their respective volume percentages. With the object of ascertaining whether ethyl-alcoholic solutions follow the same law, the viscosities of ethyl-alcoholic solutions of various liquids, chiefly organic, have been measured. It is found that the formula can be applied to the solutions of all the substances examined, the error being less than 1% for solutions containing less than 10% by volume of the dissolved substance. Water, however, forms an exception; in this case, the formula can be applied only to very dilute solutions. When the concentration exceeds 3% by volume, the error is greater than 1%. W. H. G.

Viscosity and Ionic Volume. FREDERICK H. GETMAN (*J. Chim. Phys.*, 1908, **6**, 577—583. Compare this vol., ii, 464).—Jones and Veazey (Abstr., 1907, ii, 438) have pointed out that the salts which diminish the viscosity of water have a large ionic volume, and there is evidence that for salts with the same anion the diminution of viscosity of the solvent is proportional to the atomic volume of the cation. In the present paper, this relationship is further illustrated by application to a number of nitrates and chlorides.

In order to show the relationship more clearly, the viscosity of solutions of the same salts is compared, when the degree of dissociation in each case is 75%. Under these circumstances, the viscosity, η, is represented by the formula :

$$10^4 \times \eta = 89 \pm 0{\cdot}0242 C_v,$$

where C_v is the atomic volume of the cation, and 89 represents the viscosity of water at 25°, there being good agreement between found and calculated values. On the other hand, there is no apparent connexion between the viscosity and the sum of the volumes of the ions and unionised molecules. G. S.

Changes in Internal Friction due to Protein Degradation. KARL SCHORR (*Biochem. Zeitsch.*, 1908, **13**, 173—176).—Experiments were carried out with dialysed salt-free serum, which was treated with sodium hydroxide in various dilutions. An Ostwald viscosimeter was used for the measurements.

On treatment with the alkali, there is at first an increase in the internal friction, which is followed by a steady fall. A similar phenomenon is brought about by hydrochloric acid ; in the latter case, however, the fall is followed by a second rise, which is accompanied by a gradual separation of a precipitate from the liquid, which is finally sufficient to impede entirely the flow of liquid through the viscosity tube. S. B. S.

Diffusion of Gaseous Ions. ÉDOUARD SALLES (*Compt. rend.*, 1908, **147**, 627—629).—The author has measured the coefficient of diffusion of gaseous ions towards the walls of narrow metallic containing tubes. The coefficient for positive ions is 0·031, and for negative ions 0·041, the value being unaffected by interchanging tubes of German silver, brass, and steel. Contrary to J. J. Thomson's supposition, the nature of the metal has no specific influence on the rate of diffusion of gaseous ions towards it. R. J. C.

Osmotic Pressure of Concentrated Solutions of Non-electrolytes. OTTO SACKUR (*Chem. Zentr.*, 1908, ii, 472 ; from *Jahrb. Schlesisch. Ges. Vaterl. Kultur*, 1908, **86**, 1—14).—According to the experiments of Morse and Frazer, aqueous sucrose solutions above 20° exert an osmotic pressure equal to the corresponding gas pressure, when the concentration is defined as the number of molecules of the dissolved substance in a volume of the solvent (Abstr., 1907, ii, 744). At lower temperatures, this agreement is not observed. If, however, the concentration is regarded as being expressed by the number of molecules of dissolved substance in a volume of the solution, the equation $p(v-b)=RT$ is applicable for all the observations with sucrose and dextrose. Contrary to the gas law, b, in the above equation, varies considerably with alteration of temperature ; for sucrose, it decreases from 0·31 (per litre) to 0·20 when the temperature rises from 0° to 20°, and for dextrose, from 0·16 to 0·093 under a like change of temperature. The author suggests that this is due to the hydration of the dissolved substance decreasing with rise of temperature. J. V. E.

Polymerisation and Dissociation of Molecules in the Liquid State. GEORGE G. LONGINESCU (*J. Chim. Phys.*, 1908, **6**, 552—566. Compare Abstr., 1905, ii, 79).—With reference to the relation between the boiling point and molecular weight, Walker has pointed out that the formula $T/\sqrt{m}=37$ (m = molecular weight; T = boiling point on the absolute scale) holds more particularly for a number of hydrocarbons, but is not generally applicable. The author now shows that the modified expression $T/\sqrt{m}+(1000\sqrt{m})/T$ is about 64 for all the normal substances examined, and varies from 65 for slightly polymerised substances to 99 for water.

The above equation has two roots, $\sqrt{m_1}=T/37$ and $\sqrt{m_2}=T/27$. The ratio $T/\sqrt{m}$ is termed x_1, and $1000\sqrt{m}/T$ is termed x_2. It is only for certain hydrocarbons and some other substances that $x_1=37$ and $x_2=27$; for the majority of substances, x_1 is less than 37, and x_2 greater than 27. This is taken to mean that, in the liquid state, the molecules of most substances are partly polymerised and partly dissociated, the mean of the weights of the molecules being the theoretical molecular weight, and the views of other observers are adduced in support of this opinion.

The "factor of dissociation," $K_1=(x_1/37)^2$, and the "factor of polymerisation," $K_2=1{\cdot}88K_1$, are given in tabular form for all the liquids considered. G. S.

The Chemical Theory of Solutions. I. K. Ikeda (*J. Coll. Sci. Tōkyō*, 1908, **25**, x, 1—80).—An ideal solution is defined as a homogeneous liquid mixture, of which the volume and energy are the sum of the volumes and energies respectively of the components in the liquid state under the same pressure and at the same temperature. An attempt is made to explain all deviations from the properties of an ideal solution by assuming reversible chemical reactions within the solution and applying the law of mass action. The treatment is mathematical, and the results are applied to concrete cases. C. H. D.

Hardness of Solid Solutions of Metals and of Definite Chemical Compounds. Nicolai S. Kurnakoff and S. F. Schemtschuschny (*Zeitsch. anorg. Chem.*, 1908, **60**, 1—37; *J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1067—1104).—The degree of hardness of a number of binary alloys, the structure of which is known, is plotted against the composition, and in the majority of cases the electrical conductivity is represented on the same diagram. The data for the bronzes and brasses and certain other alloys are due to previous observers, and the authors have themselves determined the hardness of the binary alloys copper-nickel, gold-copper, and gold-silver. It is shown that practically the same results are obtained whether the hardness is determined by the sclerometer (ruling lines on a prepared surface of the alloy), by the resistance to penetration, or by other methods.

The more important results of the investigation are as follows: (1) the formation of mixed crystals is accompanied by an increase in hardness; (2) the hardness of an unbroken series of mixed crystals can be represented by a continuous curve showing a maximum; (3) in the latter case, the maximum of the curve of hardness coincides with the minimum of the curve of electrical conductivity. (4) At points corresponding with the extremities of the series of mixed crystals (when the miscibility of the metals is incomplete), there are breaks in the curve of hardness.

Experiments have also been made on the pressures required to force certain plastic binary mixtures in a thin stream through a small opening, and the pressures just sufficient for this purpose are plotted against the composition. These limiting pressures are roughly proportional to the hardness of the alloys. The curves for the isomorphous mixtures of *p*-dichloro- and *p*-dibromo-benzenes and of silver chloride and bromide show maxima, but that for zinc-tin alloys shows no maximum, corresponding with the fact that these metals have little or no tendency to form solid solutions.

Finally, when the metals form a chemical compound, the latter may be harder or softer than either of the components, and the curve obtained by plotting hardness against composition may show either a maximum or minimum. A number of examples illustrating this case are cited. G. S.

Causes Modifying the Dominant Faces of Crystals: Solid Solutions. Paul Gaubert (*Compt. rend.*, 1908, **147**, 632—635. Compare Abstr., 1906, ii, 343).—Foreign matter is distributed between crystals and their mother liquor in a definite ratio. The crystalline habit may be modified, not only by crystallisable foreign matter, but by liquid molecules, and even by the mother liquor itself.

Crystals of phthalic acid from aqueous solutions are modified in the same sense by methyl, ethyl, and propyl alcohols, glycerol or aldehyde in small quantities. The minute amount of alcohol in the crystals augments as the proportion of alcohol in the mother liquor increases, but the alcohol is not merely in the state of occluded mother liquor. Methylene-blue, which favours a different crystalline habit in phthalic acid, also hinders the entrance of alcohol into the growing crystals. R. J. C.

Ultra-microscopic Observations. J. Reissig (*Ann. Physik*, 1908, [iv], **27**, 186—212).—The colloidal solutions of brown, tellurium, selenium, and silver, and of red and blue gold, prepared by Paal (compare Abstr., 1902, ii, 500, 508; 1905, ii, 158) have been examined by means of the ultra-microscope. These solutions contain the sodium salts of protalbic and lysalbic acids (compare Abstr., 1902, i, 653), which act as protective colloids. From the number of particles contained in a given volume, the linear dimensions of the particles of the colloidal elements are calculated. It is found that the number of observable particles is not proportional to the concentration of the dissolved colloid, for all the particles can only be seen in dilute solutions. The number of particles seen through the ultra-microscope is, for a given solution, proportional to the intensity of the source of light used.

The ultra-microscope has also been employed to examine the behaviour of colloidal gold solutions on the addition of hydrochloric acid. The slowness with which flocculation takes place is supposed to represent the stability of the solution, and for both red and blue solutions, one maximum and two minimum positions of stability have been identified. The position of maximum stability corresponds with the isoelectric point of the solution. In dilute solutions the stability of the colloidal gold is greater than it is in concentrated. The rate at which a given quantity of hydrochloric acid causes flocculation to take place depends on the concentration of the acid, the rate decreasing as the concentration of the acid decreases.

H. M. D.

The Dynamic Theory of a Reversible Chemical Reaction. II. Ernst Cohen and Th. Strengers (*Chem. Weekblad*, 1908, **5**, 719—721. Compare this vol., ii, 824).—Polemical. A reply to Smits and Wibaut. A. J. W.

The Dynamic Theory of a Reversible Chemical Reaction. Andreas Smits and J. P. Wibaut (*Chem. Weekblad*, 1908, **5**, 771—772). —Polemical. A reply to Cohen and Strengers (this vol., ii, 824).

A. J. W.

Lecture Experiment to Demonstrate the Law of Mass Action. Emil Abel (*Zeitsch. Elektrochem.*, 1908, **14**, 630—631).—The diminution of the concentration of the hydrogen ions in a solution of acetic acid by sodium acetate is shown by means of the reaction between hydriodic acid and hydrogen peroxide. In acid solutions, iodine is liberated; in almost neutral solutions, oxygen is given off. The difference between a solution of acetic acid, potassium iodide, and hydrogen peroxide, on the one hand, and the same solution with the addition of sodium acetate, on the other, is very striking (compare this vol., ii, 939). T. E.

Application of the Kinetic Theory to the Metals. G. Reboul (*Chem. Zentr.*, 1908, ii, 473; from *Le Radium*, 1908, **5**, 129—136).—It is assumed that in metals there are free negative electrons and positive atom ions. The free electrons must, then, have a definite tendency to pass from the metal into the surroundings. It therefore follows that at the perimeter there must be a double film metal/gas, and also a potential difference, as in the Nernst theory for the perimeter metal/solution. The equilibrium between the electrons that leave the metal and the electrical energy is influenced by a change of temperature. In this is found a simple explanation of the phenomena of electric capillarity, thermal electricity, and electron rays when substances are strongly heated. J. V. E.

Velocity of Reaction. Johannes J. van Laar (*Chem. Weekblad*, 1908, **5**, 747—764).—A theoretical paper containing a continuation of the author's statement of his new thermodynamic theory (this vol., ii, 824). A. J. W.

Equilibrium of Two Substances in a Mixed Binary Solvent. E. D. Volchonsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 941—993).—A theoretical paper, in which the author considers: (1) The coefficient of distribution in a homogeneous system,

(2) Le Chatelier's principle of the opposition of action and reaction, and the conditions of existence of inverse systems. (3) Equilibrium of heterogeneous systems. (4) The energy relations between the members of a system. (5) The influence of temperature on the equilibrium of the system. (6) The classification of the reactions effecting the equilibrium of the system. T. H. P.

Equilibria in Quaternary Systems. FRANS A. H. SCHREINEMAKERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 138—142. Compare this vol., ii, 571).—The system copper sulphate, ammonium sulphate, lithium sulphate, and water has been studied at 30°. In addition to the three sulphates named, there are two solid compounds involved in the equilibria, namely, $CuSO_4,(NH_4)_2SO_4,6H_2O$ and $Li_2SO_4,(NH_4)_2SO_4$. The equilibria are represented with the aid of a tetrahedron, all saturation lines and surfaces being projected perpendicularly on one of the side planes of the tetrahedron. J. C. P.

Kinetics of Successive Reactions. Reduction of Chromic Acid by Oxalic Acid. K. JABŁCZYŃSKI (*Zeitsch. anorg. Chem.*, 1908, **60**, 38—49.* Compare Luther and Rutter, Abstr., 1907, ii, 555).—The rate of reaction between chromic acid and excess of oxalic acid in dilute solution has been measured at 15°, the course of the reaction being followed by estimating the concentration of chromic acid in a portion of the solution from time to time with iodide and thiosulphate. The velocity is proportional to the concentration of the chromic acid when different initial concentrations of the latter are used, but the constants calculated according to the unimolecular formula increase considerably during the reaction. Excess of chromic salt does not influence the rate of the reaction.

On the assumption that the reaction takes place in the three stages $Cr^{VI} \longrightarrow Cr^{V}$ (1), $Cr^{V} \longrightarrow Cr^{IV}$ (2), $Cr^{IV} \longrightarrow Cr^{III}$ (3), and that all three reactions are unimolecular, an equation is deduced from which, by an approximation method, the following values are obtained for the constants of the three successive reactions $k_1 = 0{\cdot}0344$, $k_2 = 0{\cdot}1322$, $k_3 = 0{\cdot}0238$. Other measurements were made in which the conditions were varied considerably, but, although the ratio of the constants calculated from these observations varied somewhat, the order remained the same.

The above conclusion, that the reaction $Cr^{V} \longrightarrow Cr^{1}$ is very rapid and that the other reaction, $Cr^{IV} \longrightarrow Cr^{III}$, is comparatively slow, is in accordance with what is known of the behaviour of quinquevalent and quadrivalent chromium salts. G. S.

Formation of Salts and Basicity of Acids. GIUSEPPE BRUNI (*Zeitsch. Elektrochem.*, 1908, **14**, 701—706).—Measurements are made of the conductivity of an acid and of mixtures of the acid and its potassium salt. In each series of measurements, the total concentration of the acid is kept constant, the series extending from pure acid at one end to pure potassium salt at the other. Acetic, formic, monochloroacetic, cyanoacetic, and di- and tri-chloroacetic acids are used; they form a series of gradually increasing strength. Each acid is used in eleven different concentrations from *N* to *N*/1024.

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* and *Bull. Acad. Sci. Cracow*, 1908, 603—620.

The results are given in the form of tables and curves. For acetic acid of normal strength, the molecular conductivity increases as the neutralisation proceeds; in weaker solutions a minimum occurs near the acetic acid end of the curve. This minimum becomes more pronounced, and is found nearer the normal salt end of the curve, with formic acid; with the stronger acids the conductivity of the acid is greater than that of its potassium salt (except in the stronger solutions), and the minimum becomes less marked as the acid used is stronger, until with trichloroacetic acid it disappears altogether, the curves being straight lines. The theoretical discussion of the results is reserved for a later paper. T. E.

Reduction of Solutions of Potassium Permanganate Acidified with Sulphuric Acid in the Presence of Mineral Salts. T. WARYNSKI and P. TCHEICHVILI (*J. Chim. Phys.*, 1908, **6**, 567—576).—The experiments were made with approximately 1/100 molar solutions of potassium permanganate and 1/30 molar sulphuric acid, and varying concentrations of salts. In some cases observations extended over four months. After the experiment, the amount of change was determined by titration with ferrous sulphate.

Most of the salts used as catalysts exerted an accelerating action in the dark, but a retarding action in daylight. Also, in green and blue light most salts retarded the action, but in orange light a slight acceleration was observed; the retarding effect, therefore, probably depends on the actinic rays.

Rise of temperature also affects the catalytic power of salts on the reaction; it increases the activity of the sulphates of iron, chromium, and aluminium, but retards the action of cadmium sulphate. The activity of certain catalysts, such as ferric alum, increases with the concentration. G. S.

Esterification of Trichloroacetic Acid. ANTON KAILAN (*Monatsh.*, 1908, **29**, 799—844. Compare this vol., ii, 28).—The esterification of mandelic acid is not retarded by the presence of water up to 4 gram-mols. per litre. The influence of water on the esterification of phenylpropionic acid is much less when trichloroacetic acid is used as a catalyst than when hydrogen chloride is employed.

The relation between the velocity constant and the concentrations of the water and hydrogen chloride in the esterification of trichloroacetic acid is expressed by the equation: $1/k = 6{\cdot}554 + 4{\cdot}850/c + 0{\cdot}0985/c^2 + (-40{\cdot}15 + 35{\cdot}39/c - 0{\cdot}9550/c^2)w + (-16{\cdot}90 + 12{\cdot}98/c - 1{\cdot}259/c^2)w^2$. The ratio of the velocity constants with hydrogen chloride and trichloroacetic acid respectively as catalysts is for phenylpropionic acid four times as great as for trichloroacetic acid. The presence of ethyl trichloroacetate does not retard the esterification. The ester is very little hydrolysed by the catalysts in nearly dry alcohol, but considerably in presence of water. The results are not in accordance with the theory of catalysis by hydrogen ions. C. H. D.

Method of Calculating Atomic Weights. LOUIS DUBREUIL (*Compt. rend.*, 1908, **147**, 629—632).—The method introduced by Hinrichs (Abstr., 1907, ii, 945) of calculating the atomic weights of all the elements present in a single reaction depends on a graphic construction, and is thus limited to reactions in which not more than three elements participate. The author develops Hinrichs' theorem analytically, obtaining equations whereby true atomic weights can be calculated from any reaction, however complex. The method consists in finding the minimum deviations from round number atomic weights which will account for experimental values within their limits of error. The true deviations are then to be obtained by averaging results obtained by different experimenters and methods. R. J. C.

Connexion between Residual Affinity and Additivity. Walter Peters (*Ber.*, 1908, 41, 3175—3186).—Although the compounds of ammonia with the salts of heavy metals have been fully examined, the compounds with the salts of more strongly electropositive metals have not been so closely examined, owing to their high dissociation pressure. The investigation has been made by means of Ley and Wiegner's apparatus (Abstr., 1905, i, 749), as the formation of the additive ammonia compound occurs in an atmosphere of ammonia, and it also allows of the effect of temperature being determined.

Well-defined increase in the number of ammonia molecules absorbed by lowering the temperature was only given by silver chloride, platinochloride, bromide, and platinocyanide; in the other cases, ammonia was absorbed, and liquids were obtained containing a large percentage of ammonia.

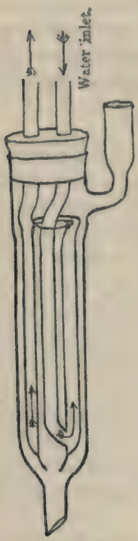
The table summarises the results obtained at the ordinary temperature, I giving the number of ammonia mols. absorbed, and II the number retained after evacuation:

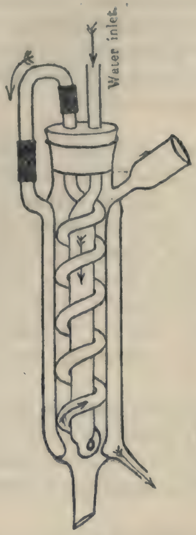
	I.	II.
Cobalt cyanide	2	0
Cobalt thiocyanate	6	2
Nickel thiocyanate	6	3
Nickel dithionate	6	4
Mercuric thiocyanate	4	1
Mercuric acetate	4	2
Mercuric propionate	4	2
Silver chloride	1·5	0
Silver bromide	1·5	0
Silver iodide	0·5	0
Silver cyanate	1	0
Silver thiocyanate	2	0
Potassium aurichloride	3	0
Potassium aurothiocyanate	5	2
Potassium aurithiocyanate	var.	4
Platinous chloride	5	4
Silver platinochloride	6	3
Potassium platinocyanide	1	0
Silver platinocyanide	4	2
Cobalt platinothiocyanide	6	2
Potassium platinothiocyanate	2	2
Silver platinothiocyanate	6	4
Sodium platinichloride	6	5
Silver platinichloride	8	4
Potassium platinithiocyanate	12	6
Silver platinithiocyanate	14	6

The platinic salts, in general, absorb more ammonia than the platinous, and the metals, gold or platinum, more than silver or mercury. W. R.

An Apparatus for Extraction by Hot Ether. Wilhelm Kulka (*Biochem. Zeitsch.*, 1908, 13, 134—137).—An extraction apparatus somewhat similar to Soxhlet's, but so modified that the vessel containing the substance to be extracted is surrounded by the ether vapour, its contents therefore being nearly at the temperature of boiling ether (about 30°). S. B. S.

New Forms of Condenser. H. Stoltzenberg (*Chem. Zentr.*, 1908, ii, 277; from *Zeitsch. Chem. Apparat.*, 1908, 3, 243—245).—The condensers described have the advantage of exposing four cooling surfaces to the vapour, are light and compact, and may be readily cleansed by removing the inner portion with the stopper. The accompanying figures should explain their construction. J. V. E.





A New Aspirating Reflux Condenser. Henri Vigreux (*Bull. Soc. chim.*, 1908, [iv], 3, 855—857).—This consists of a Liebig condenser in which the water outflow pipe is fused to a small aspirator acting on the principle of an ordinary filter-pump. The air-exhaust tube of this aspirator is connected with the upper end of the inner condensing tube. The latter is provided on its inner surface with points and mounds in order to facilitate condensation. The effect of a current of water through the condenser envelope is thus to produce an upward current of air in the inner condensing tube, and it is claimed that such a condenser placed above an open vessel (basin, beaker or flask) containing the boiling liquid condenses the whole of the vapours, returning the condensed liquid to the vessel even when the liquid consists of ether, alcohol, light petroleum, or carbon disulphide. The apparatus is also of use in reactions involving hydrogen chloride or bromine or iodine vapours. E. H.

A New Aspirating Condenser and Recuperator for Rapid Evaporations. Henri Vigreux (*Bull. Soc. chim.*, 1908, [iv], 3, 858).—This is simply the condenser described previously (preceding abstract), of which the inner tube is provided, immediately below the outer jacket, with a side-tube arranged to collect the condensed liquid and to convey it through a trap (to prevent the aspirator from drawing air through this side-tube) into a receiver. Solutions in ether, light petroleum, benzene, or carbon disulphide can be thereby rapidly evaporated without risk of ignition. The lower end of the condenser should be placed slightly above the surface of the liquid when the latter is contained in a basin, and in the middle of the neck of a flask when this vessel is used. E. H.

A Simple Form of Sprengel Vacuum Pump. James Arthur Pollock (*J. Roy. Soc., New South Wales*, 1907, 41, 140—143).—A modified short fall Sprengel pump, in which the raising of the mercury is effected by evaporating the mercury at a lower and condensing it at a higher level; the mercury on reaching the bottom of the fall tube enters a horizontal tube, the farther end of which is bent vertically upwards; this vertical limb bears a bulb in which the mercury is boiled, the vapours being condensed by passing through a Liebig's condenser the lower end of which is connected to the fall tube. The apparatus must be used in connexion with an efficient auxiliary pump. P. H.

Turbine Funnel for Mixing Solutions. A. GAWALOWSKI (*Zeitsch. anal. Chem.*, 1908, **47**, 697).—The apparatus is intended for the purpose of mixing a reagent with a solution. It consists of a funnel the stem of which is provided at the bottom with two arms placed at right-angles to the stem and ending in fine curved jets. A glass bulb is attached to the stem just below the funnel, and acts as a float, whilst the apparatus is kept in an upright position by means of a small quantity of mercury contained in a bulb below the two arms. The apparatus is floated in a solution contained in a beaker, and the reagent is poured into the funnel; as it escapes into the solution through the jets, the apparatus is caused to revolve, and the reagent and solution are thus mixed. W. P. S.

Inorganic Chemistry.

Catalysis of Hydrogen Peroxide by Iodine and Iodine Ions. EMIL ABEL (*Zeitsch. Elektrochem.*, 1908, **14**, 598—607).—The reactions between hydrogen peroxide and iodine or iodine ions are: (1) $H_2O_2 + I_2 = 2H^{\cdot} + 2I' + O_2$ and (2) $H_2O_2 + 2I' + 2H^{\cdot} = 2H_2O + I_2$. The first is very rapid in alkaline solutions, and the second is rapid in acid solutions; in solutions containing a suitable small quantity of hydrogen ions, the two may take place with equal velocity, and the result is then simply decomposition of hydrogen peroxide, the concentrations of the iodine and iodine ions remaining unchanged. The ratio between the quantities of iodine and iodine ions which must be present in order to make the two reactions proceed equally fast depends on the concentration of the hydrogen ions. A large number of experiments, in which the concentration of the hydrogen ions is kept constant by adding acetic acid and sodium acetate to the solutions, are made which are in complete agreement with these views.

Bredig and Walton's observations (Abstr., 1904, ii, 319) on the catalysis of hydrogen peroxide by neutral iodides are explained by the same reactions, for in this case when reaction (2) has proceeded to a very small extent, the solution becomes alkaline and reaction (1) then proceeds exceedingly fast, the stage at which the two have equal velocity is therefore attained when a very small quantity of iodine has been liberated. T. E.

Non-existence of a Polymeride of Chlorine. E. BRINER and E. DURAND (*Zeitsch. Elektrochem.*, 1908, 14, 706—707).—The authors have investigated the effect of the silent discharge on carefully-purified chlorine at a temperature but little above its boiling point. The experimental arrangements could have detected a contraction of 1/2000 of the volume of the gas, but no change was observed. The activity of chlorine observed by Kellner (Abstr., 1902, ii, 649) and Russ (Abstr., 1905, ii, 381) is possibly due to ozone or oxides of chlorine. T. E.

Absolute Density of Hydrogen Sulphide. GEORGES BAUME and F. LOUIS PERROT (*J. Chim. Phys.*, 1908, 6, 610—619).—Hydrogen sulphide from several sources, purified by fractional distillation, was employed. The density was determined by the method already described (this vol., ii, 372), except that an oil gauge was interposed between the gas and the mercury.

The mean value of nearly twenty experiments for the weight of a litre of the gas at 0° and 760 mm. is 1·5392 grams. From this result, the atomic weight of sulphur has been calculated by Guye's method from the critical constants. The mean result is $S = 32{\cdot}070$ ($H = 1{\cdot}00775$), in excellent agreement with the gravimetric determinations of Richards and Jones (Abstr., 1907, ii, 685). G. S.

Preparation of Azoimide. JOHANNES THIELE (*Ber.*, 1908, 41, 2681—2683).—Azoimide is obtained in good yield by the action of ethyl nitrite on hydrazine in presence of alkali. Hydrazine hydrate (1 mol.) is mixed with $4N$ sodium methoxide ($1\frac{1}{2}$ mols.), ethyl nitrite ($1\frac{1}{2}$ mols.), and ether, and the mixture allowed to remain, first in ice, and then at the ordinary temperature. After twenty-four hours, the sodium azoimide is collected and washed. The yield is nearly quantitative. Instead of the hydrate, hydrazine sulphate may be used; this is ground with $3\frac{1}{2}$ mols. of sodium methoxide for six hours, the sodium sulphate filtered off, and the filtrate treated with ethyl nitrite and ether. For the direct preparation of free azoimide, hydrazine sulphate is shaken for six hours with aqueous sodium hydroxide and ethyl nitrite; in this way, 80—84% of the hydrazine is converted into azoimide. Sodium azoimide is also formed by heating hydrazine hydrate with aqueous sodium nitrite, preferably in presence of hydrazine sulphate or sodium hydroxide, but the reaction is slow and incomplete. J. C. C.

Formation of Nitric Oxide in the High Tension Arc. FRITZ HABER and ADOLF KOENIG (*Zeitsch. Elektrochem.*, 1908, 14, 689—695). —The authors have continued their experiments (this vol., ii, 34) by passing the high tension arc through nitric oxide at about 100 mm. pressure. A platinum wire of 0·01 mm. diameter, stretched across the quartz tube in which the arc is produced, melts when the current is increased to 0·2 ampere. The temperature is therefore not much above the melting point of platinum. Using the same current and passing the gas through the tube at the same rate, the percentage of nitric oxide (about 14·5) leaving the arc is the same whether nitric oxide is used or a mixture of equal volumes of oxygen and nitrogen. The temperature is at most some hundreds of degrees above the melting point of platinum, and the equilibrium is therefore electrical, that is, due to ionic collisions, and not thermal. T. E.

Interaction of Nitric Oxide and Oxygen. WILHELM HOLWECH (*Zeitsch. angew. Chem.*, 1908, **21**, 2131—2135).—Mandl and Russ's observations (this vol., ii, 272) suggest that nitric oxide reacts only slowly with pure oxygen, the reaction being accelerated by the presence of catalysts. As this is of great importance for the practical working up of the nitric oxide which is formed in the electric furnace, the present author has endeavoured to prepare a non-reacting mixture of nitric oxide and ozonised oxygen with the object of studying the effect on it of catalysts. The apparatus employed is figured, and the results of the experiments represented by curves. It is found that 2 vols. of nitric oxide react with 1 vol. of oxygen almost completely at the atmospheric pressure with formation of NO_2 and N_2O_4. The velocity of the reaction, by constant volume, is approximately the same for oxygen prepared from air by Linde's method, ozonised oxygen, oxygen from barium peroxide, and oxygen from potassium dichromate and sulphuric acid. G. Y.

Action of Nitrous Gases and Oxygen on Water. FRITZ FOERSTER and M. KOCH (*Zeitsch. angew. Chem.*, 1908, **21**, 2161—2172).—A résumé is given of the work of various authors on the preparation of nitric and nitrous acids from the nitric oxide formed by combustion of atmospheric nitrogen. It is pointed out that the concentration of the nitric acid formed by the action of a mixture of nitrogen dioxide and oxygen on water must reach a limit, which is a function of the velocity with which the equilibrium $2NO + H_2O \rightleftharpoons HNO_3 + HNO_2$ is reached, and, therefore, of the concentration of the nitrogen dioxide, since the lower the partial pressure of the dioxide the smaller will be the concentration of its solution in the water, and hence the velocity of its reaction with the water. On the other hand, the larger volume of undissolved gases passing through the solution will cause more rapid evaporation, in which the nitric acid takes part even at concentrations far below 68%. The maximum concentration of nitric acid which can be obtained by the action of a mixture of nitrogen dioxide and oxygen on water, must lie about this percentage, since, when solutions containing higher percentages are evaporated, the nitric acid volatilises more rapidly than the water. For the same reasons, the limit concentration must be the lower the more rapid the current of gas. These views are confirmed by the results now obtained on studying the action on water of mixtures of nitrogen dioxide with oxygen and with air in varying proportions. The apparatus employed is figured, and the results are tabulated.

The formation of nitric acid takes place fairly rapidly until the solution contains about 54% of acid, a concentration corresponding with the composition $HNO_3,3H_2O$, when, in consequence of the greatly diminished amount of free water, the reaction becomes greatly retarded. It is found that, whilst the concentration of a 64·22% acid is raised to 67·6% by the action at 0° of a mixture containing 63·2% by volume of nitrogen dioxide, at 60° the concentration is raised by the same mixture, passing into the nitric acid at the same rate and for the same period, only to 65·2%. The higher temperature is the more unfavourable to the reaction, which is, therefore, probably one between water, oxygen, and the bimolecular dioxide, N_2O_4.

The influence of the partial pressure is shown in that, whilst almost the whole of the dioxide of a mixture of 2·5 vols. of nitrogen dioxide with 6·0 vols. of oxygen is absorbed by water with formation of a 37% acid, under the same conditions only 53% of the dioxide of a mixture of 2·5 vols. of dioxide and 122 vols. of oxygen is absorbed with formation of a 27·73% acid.

Whilst at low concentrations the velocity of the reaction is affected only slightly by the rate at which the gases are passed into the water, a marked effect is produced at concentrations over 50% of acid. Equal volumes of a mixture containing 5·0 vols. of dioxide and about 12 vols. of oxygen, when passed into water at the rates of 4·25, 8·5, and 17·0 litres per hour, yielded 58·78%, 55·36%, and 53·95% acids respectively. The bearing of the experimental results on the behaviour of nitrous acid also is discussed. G. Y.

Molecular Weight and Hydrates of Hypophosphoric Acid. ARTHUR ROSENHEIM and MAX PRITZE (*Ber.*, 1908, **41**, 2708—2711).—The controversy between Rosenheim, Stadler, and Jacobsohn (Abstr., 1906, ii, 744) and Parravano and Marini (Abstr., 1906, ii, 744) as to the molecular weight of hypophosphoric acid has led the authors to determine the molecular weights of the methyl and ethyl esters of pyro- and of hypo-phosphoric acids in methyl or ethyl iodide by the ebullioscopic method, with results which indicate that the formulæ of the acids are $H_4P_2O_7$ and H_2PO_3 respectively.

The monohydrate, H_2PO_3,H_2O, m. p. 62°, appears to be the only hydrate stable between 0° and 60°; Joly's anhydride (Abstr., 1886, 662), or Sänger's hydrate, $H_2PO_3,\frac{1}{2}H_2O$, could not be obtained. C. S.

Coagulation of [Colloidal] Arsenious Sulphide by Barium Chloride. JACQUES DUCLAUX (*J. Chim. Phys.*, 1908, **6**, 592—595).—When a colloidal solution of arsenious sulphide is precipitated by barium chloride, part of the barium is carried down with the precipitate and the remaining solution is acid. This is usually accounted for on physical lines as being due to absorption of the barium by the sulphide with consequent hydrolysis of the salt (Whitney and Ober, Abstr., 1902, ii, 65), although Linder and Picton (Trans., 1895, **67**, 63) showed that the sulphide usually contains excess of hydrogen sulphide, and that in the presence of barium chloride barium sulphide is formed and hydrogen chloride set free.

The author now shows that when a colloidal solution of arsenious sulphide containing excess of hydrogen sulphide, which has been kept well stoppered for five years, is precipitated with barium chloride and filtered, the filtrate contains no hydrogen sulphide, but a certain amount of arsenious acid; the latter corresponds approximately with the amount of hydrogen chloride in the filtrate, and therefore with that of the barium absorbed. The author considers that neither of the above explanations of the phenomenon are satisfactory; it is probable that there is double decomposition between the barium chloride and the sulphide, perhaps by replacement of an AsO group existing in the sulphide by barium. G. S.

Preparation of Carbon Monoxide. ERWIN RUPP (*Chem. Zeit.*, 1908, **32**, 983).—A known weight of sulphuric acid is heated in a generating flask to 100°, and an equal weight of 98% formic acid is dropped in from a stoppered funnel. A regular stream of pure carbon monoxide is thus evolved; when the action slackens, a gentle heat is again applied by means of a small flame. L. DE K.

Simple Arrangement for Filling Glass Tubes with Liquid Carbon Dioxide. ALFRED THIEL (*Chem. Zentr.*, 1908, ii, 470—471; from *Zeitsch. Chem. Apparat.*, 1908, **3**, 240—243).—An arrangement is described for filling evacuated glass tubes with carbon dioxide to allow of the demonstration of the critical temperature of this gas. The glass tube to be filled is placed in a cooling bath of solid carbon dioxide and ether, and is connected by a stout capillary tube to a compression tube, which is regulated by an adjustable head of mercury. Air-free carbon dioxide is admitted to the compression tube by lowering the head of mercury, when, by closing a tap on the inlet tube and opening a tap connecting with the exhausted condensing tube and increasing the head of mercury, the enclosed carbon dioxide is transferred to the cooled tube, where it is condensed. By repeating this operation several times, any required quantity of carbon dioxide may be condensed in an expeditious manner. J. V. E.

Argon in Radioactive Zirconium Minerals. A. VON ANTROPOFF (*Zeitsch. Elektrochem.*, 1908, **14**, 585—586).—The gas extracted from a feebly radioactive Brazilian mineral containing 97% of zirconia consisted mainly of carbon dioxide with smaller quantities of hydrogen and nitrogen and traces of helium and argon. This is the second mineral in which argon has been found; the first was also a radioactive zirconium compound (Trans., 1906, **89**, 1568). T. E.

Analysis of the Atmospheric Gases Non-liquefiable in Liquid Air. FRÉD BORDAS and TOUPLAIN (*Compt. rend.*, 1908, **147**, 591—594).—A modified form of the apparatus described previously (this vol., ii, 430) has been employed for the analysis of the gases which escape liquefaction when liquid air is distilled and the oxygen and nitrogen condensed. A table is given of the wave-lengths of the lines observed in the spectrum of this gas after removal of all the oxygen and nitrogen. This includes, besides those observed by Baly for neon and helium, the red lines of wave-lengths 7267, 7050, 6943, 6732, 6610, 6572, 6535, 6509; the orange lines, 5905, 5890; the yellow lines, 5820, 5808, 5765, and the green lines, 5750, 5722, 5694, 5659, 5569, 5441, 5407, 5348, 5336, which the authors attribute to neon, but which have not been observed previously.

The conclusion is drawn that the gases in the atmosphere non-liquefiable in liquid air consist of neon and helium. E. H.

Liquefaction of Helium. H. Kamerlingh Onnes (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, 11, 168—185; *Compt. rend.*, 1908, **147**, 421—424).—The actual work carried out with the object of liquefying helium was preceded by a study of the isothermal lines for such temperatures as can be attained by the use of liquid hydrogen. The results of this study made it very probable that the Joule-Kelvin effect would not only give a decided cooling at the melting point of hydrogen, but that this would be sufficient to make a Linde-Hampson process successful. The construction of the helium liquefier was therefore an imitation of the hydrogen liquefier described in a previous communication.

The helium employed was obtained by heating monazite sand. The gas was then successively exploded with oxygen, cooled with liquid air, compressed, and led over charcoal at the temperature of liquid air. It was then passed through a column of hot copper oxide, compressed over charcoal at the temperature of liquid air, and further led over charcoal under pressure at the temperature of liquid hydrogen, until the gas which had been absorbed in the charcoal and then separately collected no longer contained any appreciable impurity.

On the day before the final experiment, 75 litres of liquid air were prepared, and on the day itself, operations began with the preparation of 20 litres of liquid hydrogen. When the helium (200 litres) had been circulating in the liquefier for about three hours, more than 60 c.c. of liquid helium was obtained. In consequence of the extreme purity of the helium, and by virtue of the special contrivances adopted, the apparatus remained perfectly transparent during the whole experiment.

The liquid helium looks as if it was almost at its critical temperature, and its surface stands out like the edge of a knife against the glass. Evaporation under diminished pressure did not lead to solidification, and the triple point pressure is certainly below 1 cm. The temperature reached in this evaporation was probably about 3° absolute.

The boiling point was found to be 4·3° absolute, but a slight correction is suggested which would make it about 4·5°. The density of the liquid is 0·15; the ratio of the density of the vapour to that of the liquid is 1 : 11 at the boiling point, indicating that the critical temperature is not much higher than 5° absolute, and that the critical pressure is not much more than 2·3 atmospheres.

The value of a, the constant of van der Waals' equation, appears for helium to be about 0·00005, and the value of b is probably about double the value which was expected (0·0005). J. C. P.

Preparation of Colourless Alcoholic Potassium Hydroxide. Adolf Halla (*Chem. Zeit.*, 1908, **32**, 890).—Thirty grams of pure stick potassium hydroxide are placed in a bottle with one litre of 95% alcohol, and left at atmospheric temperature until solution is effected, the bottle being shaken from time to time. The clear supernatant liquid is then carefully siphoned off into another bottle, which is stoppered and exposed to diffused daylight. The solution is thereby bleached in the course of a few days, and remains colourless so long as it is kept in diffused daylight. P. H.

The Partition of Silver between Zinc and Lead. G. N. Potdar (*J. Coll. Sci. Tōkyō*, 1908, **25**, ix, 1—13. Compare Wright and Thompson, Abstr., 1890, 336).—Silver-lead alloys were melted with zinc in an atmosphere of carbon dioxide, the temperature being maintained at 540° by means of a bath of boiling phosphoric sulphide. After stirring, the mass was allowed to remain fluid for five and a-half hours, rapidly cooled, and the silver in the two solidified layers estimated. The whole of the zinc layer has to be taken for analysis, as the distribution of zinc in it is far from uniform, owing perhaps to segregation during cooling. At 540°, silver is about 300 times more soluble in zinc than in lead, and this partition-coefficient is practically independent of the concentration of the silver.

In Parkes' process for the desilverisation of lead, the solid zinc scum is removed at 325—360°. Experiments at this temperature indicate that the removal of silver by the zinc is practically complete, the partition-coefficient at 358° varying in three trials from 1300 to 5700. C. H. D.

The Silver Hydrogel in Photographic Films. Lüppo-Cramer (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 135—136).—The peculiarities of the silver deposits obtained with different developers, and with gelatin or collodion films, are explained by the more or less completely colloidal nature of the silver, and by adsorption of different substances from the developers (compare this vol., ii, 841). T. E.

Use of Metallic Deposits in Metallography. II. Federico Giolitti (*Gazzetta*, 1908, **38**, ii, 352—357).—The author has applied the method devised by him (Abstr., 1906, ii, 759) to the qualitative study of alloys constituted of solid solutions. When a polished surface of a binary alloy containing mixed crystals either of two metals or of one of them and a compound of the two is immersed in a solution containing ions of the more electronegative or more noble of the two metals, differences of potential are established between the various portions of the surface. The cations of the solution will be deposited in the metallic state on the different parts of the section with a velocity increasing with the concentration of the more electronegative metal. By varying the concentration of the solution and the duration of immersion, or by observing the section under the microscope, the gradual and continuous variations of the metallic deposit on that part of the surface occupied by the mixed crystals can be followed. These variations, which correspond with differences in the concentration of the more noble metal in the mixed crystals, give an immediate indication that the constituent in question is a solid solution, and also permit the observer to judge the heterogeneity of concentration of this solid solution. Various bronzes have been studied in this way, microphotographs of the different sections after treatment with chromic oxide or with copper sulphate solution being given. T. H. P.

Magnesium Oxychloride Formed by Electrolysis of the Residual Solutions from the Manufacture of Potassium Chloride, and its Importance for the Preparation of Bromine by Kossuth and Mehns's Method. HANS HOF (*Chem. Zeit.*, 1908, **32**, 993).—It has been found that the yield of free bromine, obtained by electrolysis of the residual solutions from the manufacture of potassium chloride, increases with the concentration of the solution electrolysed. On dilution with water, the electrolysed solution containing free bromine becomes gradually less yellow, and finally colourless, when the solution is found to contain only combined bromine; this may be again liberated by sulphuric acid. If the bromine is first removed by means of an organic solvent, the electrolysed solution, on dilution, becomes alkaline and opaque, in consequence of the separation of magnesium hydroxide. It is considered that magnesium hydroxide, formed during the electrolysis, remains dissolved in the concentrated magnesium chloride solution, forming a basic salt. This is decomposed by water with liberation of magnesium hydroxide, which then reacts with the free bromine. In agreement with this, analytical figures are given, showing that the proportion of bromine present as bromate to the free bromine increases with the dilution of the electrolysed solution.

By electrolysis of a concentrated solution of magnesium chloride, the author has obtained a neutral solution which does not react with bromine. When diluted, it becomes alkaline, and deposits magnesium hydroxide. The concentrated solution slowly deposits a white, amorphous mass, $MgCl_2,5MgO$ (Bender, *Annalen*, 1871, **159**, 341; Davis, *Chem News*, 1872, **25**, 258), which is stable at 160° and yields magnesium chloride when treated with cold water, but is completely decomposed only by boiling water. G. Y.

Electrolytic Oxidation of Copper. F. SCHMIEDT (*Chem. Zentr.*, 1908, ii, 386; from *Elektrochem. Zeitsch.*, 1908, **15**, 53—56).—The author has repeated the work of Müller and Spitzer (Abstr., 1907, ii, 174), and finds that, besides cupric oxide and copper peroxide, there is also formed cuprous oxide, which, however, becomes decomposed by the hydrogen peroxide that is also produced. Copper peroxide is formed in largest quantities at the beginning of the electrolysis, when the temperature is low. J. V. E.

Alloys of Copper and Tin. FEDERICO GIOLITTI and G. TAVANTI (*Gazzetta*, 1908, **38**, ii, 209—239).—The results obtained by the authors in studying the freezing points and microscopic appearance of the copper-tin alloys agree, in general, with those of Heycock and Neville (Abstr., 1901, ii, 508; 1902, ii, 261). The freezing-point diagram of these alloys is divided clearly into two parts, the first comprising alloys containing from 0 to 38·34% of tin, and the second, those containing more than 38·34% of tin. Thus the diagram is a complex one, resulting from the combination of the equilibrium diagrams of $Cu-Cu_3Sn$ and Cu_3Sn-Sn. The diagram is discussed in detail. T. H. P.

Copper and Iron Salts in Presence of Alkalis and Acids. Hermann Frischer (*Chem. Zeit.*, 1908, 32, 1005—1006).—Experiments are described to show that the action of sodium hydroxide on a mixture of ferrous and cupric sulphates takes place, contrary to Millberg's supposition (*Chem. Zeit.*, 1906, 30, 511; 1907, 31, 1143), according to the following equations: (1) $2CuSO_4 + 4NaHO = 2Cu(OH)_2 + 2Na_2SO_4$, and (2) $2FeSO_4 + 2Cu(OH)_2 = Fe_2(OH)_4SO_4 + Cu_2SO$. The action of air on the resulting mixture leads to the formation of ferric hydroxide and cupric sulphate, the whole reaction being represented by the equation: $2FeSO_4 + 2CuSO_4 + 4NaHO + H_2O + O = 2Fe(OH)_3 + 2CuSO_4 + 2Na_2SO_4$. Any further addition of alkali must result in precipitation of copper hydroxide. As the equation shows, the copper sulphate acts as the oxygen carrier; in agreement with this view, if potassium sodium tartrate and an excess of alkali are added to the mixture of ferrous and cupric salts, cuprous hydroxide is precipitated in the cold, and on heating is converted into the red anhydride, whilst the ferric salt remains in solution. If a sufficient excess of ferrous salt is present, the cuprous hydroxide is reduced to metallic copper. This reaction may be employed for the detection of ferrous salts.

If a ferrous salt is added to an ammoniacal solution of a cupric salt, ferric hydroxide is precipitated, whilst the blue colour of the solution gradually disappears; the cuprous salt remaining in solution is rapidly oxidised by air. In this case, also, the precipitation of the ferric hydroxide may be prevented by addition of a tartrate or a citrate.

The behaviour of copper and iron salts in presence of ammonia affords a ready means of preparing cuprous solutions for the absorption of carbon monoxide in gas analysis. It is evident, moreover, that, in the separation of iron and copper by means of ammonia, a preliminary oxidation of ferrous salts is unnecessary if the amount of copper present is equal to, or greater than, that of the iron. On the other hand, if the copper is to be estimated colorimetrically, the ferrous salts present must first be oxidised.

In acid solution, cuprous salts are oxidised at the expense of ferric salts, according to the equation: $Cu_2O + Fe_2O_3 = 2CuO + 2FeO$.

G. Y.

Equilibrium in the Reaction between Lead Sulphide and Its Oxidation Products. III. Rudolf Schenck and W. Rassbach (*Ber.*, 1908, 41, 2917—2925).—Previous investigations (Abstr., 1907, ii, 546, 619) have shown that the metallurgically important reactions: (I) $PbS + PbSO_4 = 2Pb + 2SO_2$; (II) $PbS + 2PbO = 3Pb + SO_2$, are reversible, the equilibrium being conditioned by a definite pressure of the sulphur dioxide, which is dependent oh the temperature only. In addition to the two temperature-pressure curves so obtained, a third was indicated, the cause of which forms the main object of the present investigation. The result shows that a basic sulphate, $PbSO_4,PbO$, is formed, which, setting up its own reversible reaction, $2[PbSO_4,PbO] + PbS \rightleftharpoons 7Pb + 5SO_2$, accounts for the existence of the third temperature-pressure curve. These three curves divide the whole temperature-pressure diagram into four fields. The final product of all reactions in the first field is lead sulphate, in the second the basic sulphate, and in the third lead oxide; these three stable phases do not evolve sulphur dioxide with lead sulphide. In the fourth field, no compound containing oxygen is stable with lead sulphide, an impure metal being obtained with evolution of sulphur dioxide. These conclusions are deduced from observations at temperatures below 820°; above this temperature, complications are introduced, owing to the mutual solubility of lead oxide and lead sulphate.

The existence of the basic sulphate, $PbSO_4,PbO$, is proved as follows. Mixtures of lead sulphate and lead oxide in known proportions are heated to 1020°, and allowed to cool. The freezing-point curve, consisting of many branches, indicates the existence of many compounds of lead sulphate and lead oxide which do not form mixed crystals with one another or with either of the components. Distinct maxima are observed at two points: (966°, 40% PbO) and 951°, 61·5% PbO); the compositions of the mixture at these points correspond with the formulæ $PbSO_4,PbO$ and $PbSO_4,2PbO$ respectively. The existence of a third basic sulphate, $PbSO_4,3PbO$, is indicated by the curve, which, however, is only stable below 880°; above this temperature, it passes into $PbSO_4,2PbO$. The presence of these basic sulphates in the fused masses containing 40—70% lead oxide is indicated by the appearance of long, transparent needles. The only basic sulphate giving in the presence of lead sulphide and a little lead a well-defined temperature-pressure curve is $PbSO_4,PbO$, as already mentioned; the others react too slowly for any trustworthy data to be obtained.

The following facts have been observed during the investigation. Lead sulphate does not melt below 1100° (compare Ramsay and Eumorfopoulos, *Phil. Mag.*, 1896, [v], **41**, 360); an exact determination cannot be made, owing to dissociation into sulphur trioxide. Pure lead sulphate shows a transition point at 850°. Mixtures of lead oxide and sulphate, rich in the former, change in volume at the ordinary temperature, the original dense mass swelling up and crumbling to a coarse powder, in which scales of lead oxide can be detected. The force exerted during the expansion distorted the containing platinum crucible. C. S.

Compounds of Lead with Nitrous Acid. ALBERTO CHILESOTTI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 173—183, 288—295. Compare this vol., ii, 845).—By measuring the *E.M.F.* of cells consisting of two lead electrodes, one immersed in a solution of a lead salt containing a known concentration of lead ions, and the other in a 0·1*N* lead nitrite solution, it is found that the concentration of the lead ions in the latter is very nearly equal to their concentration in a lead chloride solution of corresponding concentration (compare Abegg and Labendzinski, Abstr., 1904, ii, 241). The lower conductivity of lead nitrite solutions, compared with those of lead chloride, is hence due, not to a less degree of dissociation (*loc. cit.*), but to a difference in the mobility of the complex ions.

The conductivity of lead nitrite solutions undergoes a gradual increase, owing to decomposition of the nitrite according to the equation: $3Pb(NO_2)_2 + 2H_2O = Pb(NO_3)_2 + 2Pb(OH)_2 + 4NO$; probably a small amount of secondary decomposition occurs with evolution of nitrous oxide. The solutions examined, after boiling and cooling, deposit nacreous scales of $Pb(NO_2)_2,Pb(OH)_2,H_2O$ or

$Pb(NO_3,NO_2),Pb(OH)_2,H_2O$.

Attempts to prepare a double nitrite of lead and potassium by mixing hot concentrated solutions of lead acetate and potassium nitrite in various proportions led, in all cases, to crystalline compounds, in which the ratio Pb : NO_2 lies between 1 : 3 and 1 : 4; the excess of lead oxide present is due probably to decomposition of the lead nitrite.

By the gradual addition of freshly precipitated and washed lead hydroxide to a boiling 30% solution of the double nitrite,

$2Pb(NO_2)_2,3KNO_2,H_2O$,

the author has prepared the basic lead nitrite, $Pb(NO_2)_2,Pb(OH)_2,H_2O$, which can be obtained in the pure, non-hydrolysed condition by gently warming the impure product with a cold saturated, crude solution of the salt, and allowing to crystallise. Under certain conditions, this basic salt separates in the form $Pb(NO_2)_2,Pb(OH)_2$. Study of the action of lead on a lead nitrate solution leads to the confirmation of the existence of the compound $4PbO,N_2O_3,H_2O$, prepared by Chevreul (*Ann. Chim.*, 1812, **83**, 72) and others. T. H. P.

Coagulation of Colloidal Aluminium Hydroxide by Electrolytes. SHIN-ICHI KAWAMURA (*J. Coll. Sci. Tōkyō*, 1908, **25**, viii, 1—29). —It has been found possible to determine the degree of coagulation of a colloidal solution of aluminium hydroxide, produced by various electrolytes, by measuring the viscosities of the solutions. The general relations found are not affected to any marked degree by the temperature, concentration of the colloidal solution, or duration of the experiment, and may be summarised as follows: (1) In those cases where coagulation occurs, the relative viscosity shows a marked rise only when the concentration of the electrolytes reaches certain values. From this point, the viscosity increases with the increasing concentration of the electrolyte to a certain limit, and then ceases to be influenced by the further addition of the electrolyte. In some cases, the degree of coagulation increases suddenly, and in others, more gradually, with the increasing concentration of the electrolyte. (2) The colloidal solution of aluminium hydroxide shows anodic cataphoresis; consequently, in accordance with Hardy's rule (compare Abstr., 1899, ii, 567; 1903, ii, 469; 1906, i, 121), only anions are found to exercise coagulating power. (3) With but few exceptions, the coagulating power of an electrolyte increases rapidly with the increasing valency of the anion; this is in agreement with Schulze's rule (compare Abstr., 1883, 295). (4) The highest degree of coagulation produced by various electrolytes differs considerably in different cases, and appears to be a characteristic of the electrolyte.

W. H. G.

Crystallised Iron from a Foundry at Teschen, Austria. FELIX CORNU (*Centr. Min.*, 1908, 545—546).—The crystals are about 3 mm. across, and have the form of distorted octahedra grouped along the three cubic axes (similar to the well-known skeletal growths of magnetite). Anal. I of the crystals, and II of the ground mass of iron in which they are embedded.

	Fe.	Si.	P.	S.	Cu.	Mn.	C.	O.
I.	95·32	0·22	0·16	—	—	1·24	1·80	1·26
II.	95·91	0·19	0·24	0·30	0·10	1·46	1·80	—

L. J. S.

Nature of the Pseudo-solutions of Ferric Hydroxide. III. FEDERICO GIOLITTI (*Gazzetta*, 1908, **38**, ii, 252—258. Compare Abstr., 1906, ii, 857).—The typical or stable ferric hydrosol, prepared by treating washed precipitated ferric hydroxide with acetic acid after keeping it in contact with water for several months and dissolving in water the residue insoluble in acetic acid, is either a ferric hydroxide containing less water than the other hydrosols and the ordinary gelatinous hydroxide, or possibly anhydrous ferric oxide; the latter view is supported by the comparative difficulty with which this hydrosol is dissolved by acids. The hydrosol of Graham, prepared by dialysis, also changes gradually into the stable hydrosol.

T. H. P.

Iodopentamminecobalt Salts. ALFRED WERNER (*Ber.*, 1908, **41**, 3007—3015).—The author finds that the substances obtained by Sand and Böckmann (this vol., ii, 44) by the action of iodine on the black nitrosopentamminecobalt salts, to which they ascribe the constitution of a complex metal ammonia containing cobalt atoms with co-ordination numbers 7 and 8, are, in reality, members of the hitherto unknown series of iodopentamminecobalt salts. For example, the product of the action of iodine on black nitrosopentamminecobalt nitrate is a mixture of *iodopentamminecobalt nitrate*,

$$[CoI(NH_3)_5](NO_3)_2,$$

with a little xantho-nitrate; the separation of the two is effected through the dichromates. By treatment with silver nitrate, the former yields aquopentamminecobalt nitrate, thus proving its constitution.

Members of the new series are readily obtained by heating aquopentamminecobalt iodide at 80°. Water is evolved, and the brown product, triturated with ammonium nitrate, yields iodopentamminecobalt nitrate. The *chloride*, *bromide*, *iodide*, and *dichromate* are described; they all have a green colour. C. S.

Relationships between Nickel and Hydrogen. M. MAYER and V. ALTMAYER (*Ber.*, 1908, **41**, 3062—3074).—The absorption of hydrogen by reduced nickel has been studied at temperatures between 360° and 560°, and at pressures between 1/15 and 4/5 of an atmosphere. The metal was obtained by the same method as was used by Sieverts (Abstr., 1907, ii, 741), but the conditions of absorption were different, as only small amounts (2·7 grams) of metal were used, and each experiment was allowed to proceed until equilibrium was attained. The amount of gas absorbed was much greater than in Sievert's experiments; thus at pressures between 1/15 and 4/5 of an atmosphere, and a temperature of 360°, 1 vol. of the metal absorbs 5·5—50 volumes of gas. The isotherms representing the relationship between the pressure of the hydrogen and the relative number of atoms of hydrogen absorbed, are straight lines; thus indicating that Henry's law holds good, and that the system nickel–hydrogen is bivariant.

The rapidity with which equilibrium is established varies considerably with the amount of hydrogen present.

The solubility coefficient, that is, the ratio weight of absorbed hydrogen in 1 litre of nickel/weight of hydrogen in 1 litre of the gas volume, varies with the temperature.

	360°.	420°.	480°.	560°.
Ratio...............	297	302	306·4	299·1

J. J. S.

Decomposition of Chromic Acid by Hydrogen Peroxide ERNST H. RIESENFELD and ALFRED WESCH (*Ber.*, 1908, **41**, 2826—2835. Compare Abstr., 1905, ii, 825).—The decomposition of chromic acid by hydrogen peroxide was measured in presence of a varying excess of chromic acid. In spite of an excess of from one to one hundred times the theoretical, the amount of oxygen evolved remained constant, averaging 1·94 atoms per molecule of hydrogen peroxide. Decomposition of chromic acid in presence of excess of hydrogen peroxide and increasing amounts of sulphuric acid showed that up to a certain point the reaction remained unchanged, 1 atom of chromium corresponding with about 4·7 atoms of oxygen. Above $2·5N$ acid, a strength known to react with hydrogen peroxide to form Caro's acid, more oxygen than 5 atoms is evolved, due to a decomposition of the Caro's acid in presence of chromic salts. When the same change is studied in presence of excess of chromic acid, it is found to be far less dependent on the amount of sulphuric acid. Above $2·5N$, Caro's acid is formed as before, with the result that slightly less hydrogen peroxide is available, and accordingly less oxygen than 2 atoms is liberated. The concentration of the sulphuric acid when chromic acid solution is dropped into hydrogen peroxide is thus without influence, and perchromic acid, H_3CrO_8, is formed; likewise, when hydrogen peroxide is dropped into excess of a mixture of potassium dichromate and sulphuric acid, the excess of chromic acid is without influence.

Spitalsky's views (Abstr., 1907, ii, 338, 942) are adversely criticised. E. F. A.

Preparation of Uranium. FEDERICO GIOLITTI and G. TAVANTI (*Gazzetta*, 1908, **38**, ii, 239—251).—The authors have investigated the various methods of preparing uranium.

The "pure uranyl acetate" of Kahlbaum or Merck is, in reality, a double sodium uranyl acetate, $UO_2(OAc)_2,NaOAc,2H_2O$, which, on ignition, yields sodium pyrouranate, $Na_2U_2O_7$, as sole product; the latter is also obtained by igniting other uranyl salts of volatile acids containing salts of the alkali metals. When sodium pyrouranate is heated to redness in a current of hydrogen, it is reduced according to the following equation: $Na_2U_2O_7 + 2H_2 = 2NaOH + 2UO_2 + H_2O$, but it is found to be impossible to remove the sodium hydroxide by washing with water.

The oxide, U_3O_8, can be obtained pure as follows: A solution of sodium uranyl acetate (100 grams) in a mixture of water (4 litres) and hydrochloric acid (50 c.c.) is precipitated by means of concentrated ammonia solution (300 c.c.), the precipitate being washed ten times by decantation with 8—10 litres of 2% ammonium chloride solution. The precipitate is then re-dissolved in hydrochloric acid, precipitated by means of ammonia solution, and washed as before, these operations being afterwards repeated a third time. On calcining the final precipitate, pure U_3O_8, free from alkali, is obtained.

When a mixture of this oxide with excess of powdered aluminium is thrown on to the surface of fused aluminium maintained at a vivid red heat, not alloys of aluminium and uranium, mixed with alumina as stated by Moissan (Abstr., 1906, ii, 601), but a mixture of uranous oxide, alumina, and aluminium are obtained. When, however, a mixture of ferric oxide with 10% of the oxide, U_3O_8, is intimately mixed with more than sufficient aluminium filings to reduce both the oxides, and the reaction started by means of barium peroxide and aluminium, the oxide of uranium is reduced to metallic uranium.

T. H. P.

New Element in Thorianite. Masataka Ogawa (*J. Coll. Sci. Tōkyō*, 1908, **25**, xv, 1—11).—A new element, which it is proposed to name *nipponium* (Np), has been isolated from thorianite, reinite, and molybdenite. Its equivalent weight is about 50 and atomic weight about 100, so that this element probably fills the gap between molybdenum and ruthenium. Two *oxides* of the element appear to exist; the higher oxide is an acidic oxide, and is reduced by zinc and hydrochloric acid to the basic oxide; the latter oxide, which in the ordinary course of analysis accompanies aluminium oxide, is separated from this by conversion into a difficultly volatile chloride by heating in a current of chlorine and carbon tetrachloride vapour. The anhydrous *chloride* so formed dissolves in water to a pale green solution, and gives a characteristic line, having a wave-length of 4882, together with two other feebler lines, in the greenish-blue part of the spectrum. The *hydroxide*, precipitated by ammonia in the presence of ammonium chloride, is almost white with a pale yellow tinge, and dissolves in alkalis; it becomes nearly black when dried at 100°. The ignited oxide is brown, and is insoluble in acids. The yellowish-green solution of the hydroxide in hydrochloric acid gives a brown precipitate when boiled with sodium thiosulphate, and a greenish-black precipitate with ammonium sulphide. A solution of the chloride acidified with acetic acid gives a yellowish-brown precipitate with potassium chromate. A brown precipitate is obtained by passing carbon dioxide into a solution of the green mass formed by fusing the oxide with sodium carbonate and potassium nitrate; it dissolves readily in dilute hydrochloric acid. The aqueous solution of the fused mass does not yield a precipitate with ammonia or ammonium sulphide, but the addition of acid to the solution containing ammonium sulphide produces a brown precipitate. W. H. G.

New Element Allied to Molybdenum. MASATAKA OGAWA (*J. Coll. Sci. Tōkyō*, 1908, **25**, xvi, 1—13).—Both molybdenite and thorianite contain a new element, closely allied to molybdenum, which is probably identical with the new tin-group element recently described by Miss Evans (Trans., 1908, **93**, 666). The equivalent of the element is about 16·7. It appears to form two *oxides*; the higher oxide resembles molybdenum trioxide, and yields *barium*, *lead*, and *silver* salts similar to the corresponding molybdates; the *mercurous* salt, however, forms golden-yellow crystals; the hydrated lower oxide (?) has a graphitic appearance, and is insoluble in hot dilute hydrochloric acid. The oxides are reduced by hydrogen to the *metal*, which is non-fusible at a red heat; it burns brilliantly in the air, forming the higher oxide. The new element differs from molybdenum in that it is soluble in hot concentrated hydrochloric acid, and gives no colour reaction when its higher oxide is reduced with zinc and hydrochloric acid, either in the presence or absence of potassium thiocyanate.

Thorianite appears to contain, in addition to this new element and nipponium (compare preceding abstract), yet another new element, the oxide of which is radioactive, and dissolves in nitric acid to a bluish-green solution. W. H. G.

A New Form of "Tin Plague." RUDOLF VON HASSLINGER (*Monatsh.*, 1908, **29**, 787—790. Compare Cohen, Abstr., 1900, ii, 212; this vol., ii, 858).—A tinned iron vessel, which had been for two years at 16—45°, showed a crystalline, brittle surface. Other masses of tin, inoculated with small portions of the crystalline tin, underwent the same change, the area affected increasing in diameter 3 to 5 mm. daily. No difference between experiments at 7°, 19°, and 37° could be noted. When tin-foil was inoculated, the change extended through the thickness of the foil. The crystalline tin preserves its appearance up to near the melting point, but becomes normal after melting and again solidifying. C. H. D.

Reduction of Vanadic Acid by Potassium Iodide. T. WARYNSKI and B. MDIVANI (*Chem. Zentr.*, 1908, ii, 763; from *Mon. Sci.*, 1908, **22**, [ii], 527—528).—With the object of ascertaining whether the reducing power of potassium iodide in an acid medium is dependent on the electrolytic dissociation of the acid employed, comparable tests have been made, using acetic acid and mono-, di-, and tri-chloroacetic acids. It is found that reduction is effected most readily in the presence of trichloroacetic acid, and least readily in presence of acetic acid. With trichloroacetic acid, the reduction proceeds quantitatively to the tetroxide, and admits of the estimation of vanadic acid by this method. J. V. E.

The Series Sodium Thioantimonate, Sodium Thiosulphate, and Water. A. D. DONK (*Chem. Weekblad*, 1908, **5**, 767—771).—From mixtures of sodium thioantimonate and sodium thiosulphate in aqueous solution at 0° and 30°, the following hydrated salts have been isolated: $Na_3SbS_4,9H_2O$; $Na_3SbS_4,9H_2O,Na_2S_2O_3,5H_2O$; $Na_2S_2O_3,5H_2O$.

A. J. W.

Passivity of Platinum. RUDOLF RUER (*Zeitsch. Elektrochem.*, 1908, **14**, 633—634. Compare this vol., ii, 601).—Two platinum anodes in series were placed in 6% and 50% sulphuric acid respectively; after twelve hours their positions were interchanged, and this was continued for seven days; each anode lost 0·7 mg. When the anodes were not moved, they each lost 0·1 mg. In the first experiment, the cathode in the 50% acid gained 1·1 mg.; hence the coating formed in the 6% acid dissolves in the strong acid. If an invisible skin of oxide forms on an anode in the strong acid, it is therefore not the same oxide as that produced in the weak acid.

T. E.

Mineralogical Chemistry.

Coloration of Minerals. KARL SIMON (*Jahrb. Min.*, 1908, *Beil.-Bd.*, **26**, 249—295).—A review is given of the literature, and experiments made on the coloration of zircon, amethyst, smoky-quartz, tourmaline, and topaz. These minerals are all decolorised when strongly heated in an atmosphere of either hydrogen or oxygen, and the temperature at which the colour is lost depends to some extent on the size of the fragments. The colour is restored on exposing the mineral to sunlight, or to the emanations of radium. The colouring matter is in each case probably inorganic, but its exact nature is unknown.

L. J. S.

Relations between Quartz, Chalcedony, and Opal. HANS LEITMEIER (*Centr. Min.*, 1908, 632—638).—The following minerals, in a state of moderately fine powder, were heated with a 50% solution of potassium hydroxide at 80° for five hours; the residue was washed with a 50% solution of potassium hydroxide before being washed with water (otherwise some of the dissolved silica is re-precipitated), and the amount of silica in solution was determined:

	Sp. gr.	Water lost at 90°.	Water lost on ignition.	Silica dissolved.
Quartz from Rauris	2·613	—	(0·22 %)	7·23 %
Chalcedony from Weitendorf	2·608	—	1·50	76·02
,, ,, ,, dehydrated	—	—	—	53·10
Chalcedony from Faroe	2·591	0·10 %	1·02	42·30
Cacholong ,, ,,	2·370	0·25	1·35	54·49
Opal (hyalite) from Bohemia	2·177	0·34	3·04	56·68
Opal (precious), New South Wales	2·121	2·40	6·23	100·00
,, ,, ,, dehydrated	—	—	—	82·34

Hot water acting for twelve hours on precious opal gelatinises the surface and dissolves 0·22%. It is concluded that chalcedony and quartz are varieties of the same mineral species, and that chalcedony does not contain any admixed opal. L. J. S.

The Reversible Alteration of Cryolite. Felix Cornu (*Centr. Min.*, 1908, 546—547).—R. Nacken (*Centr. Min.*, 1908, 38) has observed the change of monoclinic cryolite to a cubic modification at a temperature of 550—570°. The suggestion is made that this cubic modification ($Na_6Al_2F_{12}$) is isomorphous with cryolithionite ($Li_3Na_3Al_2F_{12}$) (Abstr., 1904, ii, 347). L. J. S.

Origin of the Boric Acid in the Soffioni of Tuscany. Giovanni D'Achiardi (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 238—239).—A reply to Nasini (compare this vol., ii, 862).
T. H. P.

Manganese and Iron Minerals from the Crystalline Schists of Broşteni, Roumania. Vasile C. Buţureanu (*Ann. Sci. Univ. Jassy*, 1908, 5, 87—108).—Fifteen analyses are given of "brostenite" (Abstr., 1901, ii, 26); they exhibit wide variations, indicating that the material is not homogeneous. Analyses are also given of wad, and a manganese and iron carbonate. L. J. S.

Vorobyevite and the Chemical Structure of Beryls. Wladimir I. Vernadsky (*Bull. Acad. Sci. Petersburg*, 1908, 975—976).—The author describes a beryl containing cæsium, to which he gives the name *vorobyevite.* From the best published analyses, the conclusion is drawn that the beryls constitute a class of minerals by themselves. Various members of this class are known, having the composition: $p\text{-GlAl}_2\text{SiO}_{12},qA$, where A is GlH_2SiO_4, $GlSiO_3$(?), Cs_2SiO_3, Li_2SiO_3, or Na_2SiO_3. In beryls not containing alkali metals, the compound $2GlAl_2Si_4O_{12}(GlSiO_3)_4(GlH_2SiO_4)$ predominates. Vorobyevite contains 4·65—10·4% of a cæsium compound of the type $GlAl_2Si_4O_{12}(GlH_3SiO_4)(Cs_2SiO_3)$. T. H. P.

Analysis of the Microcline from the Pegmatites of Mesvres. Philippe Barbier (*Bull. Soc. chim.*, 1908, [iv], 3, 821—822).—The pegmatites of the Mesvres valley contain a beautiful slightly translucent, laminated, milk-white, or pink microcline. The author has analysed specimens of this mineral collected at Mesvres, and obtained the following results. An analysis by Damour of specimens of the same microcline found at Broye is given for comparison:

		SiO_2.	Al_2O_3.	K_2O.	Na_2O.	Total.
I.	Mesvres	66·12	19·11	10·54	4·12	99·93
II.	,, ...	66·13	19·09	10·62	4·12	99·96
III.	Broye	64·80	19·90	12·11	2·10	98·91

E. H.

Analysis of the Christianite of Simiouse. PHILIPPE BARBIER (*Bull. Soc. chim.*, 1908, [iv], **3**, 822—823).—The cavities in a basalt of Mt. Simiouse, near Montbrison, contain microscopic crystals of christianite and other minerals. The christianite gave on analysis:

SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	BaO, MgO.	Loss on ignition.	Total.
52·10	18·33	4·96	6·89	1·12	traces	16·55	99·95

This mineral thus corresponds closely with the formula

$$Si_5O_{14}Al_2(K,Ca_{\frac{1}{2}}) + 5H_2O.$$

E. H.

Aloisiite: a New Hydrosilicate from the Tufa of Fort Portal (Uganda). LUIGI COLOMBA (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 233—238).—The silicate contained in the tufa of Fort Portal is of a type extremely poor in silica, and after deducting admixed calcium carbonate and gangue, has the following composition:

SiO_2.	FeO.	CaO.	MgO.	Na_2O.	H_2O.	Total.
24·52	20·56	26·50	11·08	9·96	6·95	99·57

These numbers correspond approximately with the formula $(R'',R'_2)SiO_6$, where $R''O$ is CaO, FeO, MgO, and R'_2O is Na_2O,H_2O. The author gives to this silicate the name *aloisiite*; it occurs also in an altered form in the tufa. T. H. P.

Formation of Kaolin. OTTO HÄHNEL (*J. pr. Chem.*, 1908, [ii], **78**, 280—294).—Analyses of a fresh (I), an effloresced (II), and a half-kaolinised porphyrite show that the processes of efflorescence and kaolinisation are not identical:

	SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.	
I.	72·9	15·4	2·89	—	0·41	4·40	5·11	0·5	per cent.
II.	70·98	15·50	3·21	traces	0·72	4·70	5·01	2·21	,, ,,
III.	75·0	18·72	1·2	—	0·2	2·31	2·78	1·03	,, ,,

On the other hand, the fresh decomposition products of a granite from under humus at Schierke closely resembles crude kaolin. The moors must, therefore, be credited with a kaolinising power. G. Y.

Calcium Sulphide (Oldhamite) in the Allegan Meteorite. WIRT TASSIN (*Proc. U.S. National Museum*, 1908, **34**, 433—434).—Certain portions of this meteoric stone when treated with acid were noticed to evolve a considerable amount of hydrogen sulphide, and an analysis of the fine powder, freed from magnetic particles, showed the presence of 16·66% CaS in an olivine-enstatite mixture. This constituent could not be detected on a microscopical examination of the stone, and it appears to be present in a finely-divided state in the ground mass. L. J. S.

Meteoric Chromites. WIRT TASSIN (*Proc. U.S. National Museum*, 1908, **34**, 685—690).—Small quantities of chromite are present in most meteorites; in stones and stony irons rarely as much as 3%, and usually less than 1%, whilst in irons there is generally less than 0·01%. The following nine analyses were made on material isolated from the meteorites named, and eight earlier analyses of meteoric chromites are quoted.

	Cr_2O_3.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	SiO_2.
I. Admire..................	65·49	—	—	33·00	0·40	0·50
II. Mount Vernon	65·01	9·95	—	18·97	5·06	—
III. ,, ,, ...	64·91	9·85	—	17·97	4·96	1·38
IV. Canyon Diablo	63·40	5·30	—	26·30	5·00	—
V. Marjalahti	61·39	1·96	—	30·46	6·70	—
VI. Hendersonville	56·73	2·98	—	29·64	2·42	—
VII. Allegan	56·70	12·38	—	27·60	4·00	— *
VIII. Admire	56·49	trace	10·20	29·92	trace	—
IX. Canyon Diablo	5·20	—	65·25	30·05	—	—

* Trace of TiO_2.

From the Admire pallasite, I was of small, non-magnetic, jet-black grains with a brilliant lustre; and VIII, of bluish-brown, magnetic particles with a dull lustre, isolated from the metallic portion of the meteorite. II, from the metallic portion of the Mount Vernon pallasite, had the form of relatively large (1 mm. across) octahedra with black colour and brilliant metallic lustre, D 4·49; whilst III had the form of minute, rounded grains, frequently enclosed in the olivine, and was brownish-black with a resinous lustre. IV, from the Canyon Diablo iron, had the form of small octahedra and rounded grains, was jet-black with brilliant lustre, and non-magnetic; IX, from the same iron, was in rounded grains, with bluish-black colour and dull lustre, and was strongly magnetic, being really a chromiferous magnetite.

Only the first of these analyses approximates to the typical chromite formula, FeO,Cr_2O_2; the others contain variable amounts of alumina and magnesia, but are of the type RO,R_2O_3. L. J. S.

Physiological Chemistry.

The Total Sugar of the Blood. Raphael Lépine and Boulud (*Compt. rend.*, 1908, **147**, 226—228).—The total amount of the reducing sugar of the blood can be ascertained by hydrolysing the clot with hydrofluoric acid, and adding the amount of reducing substance thus obtained to that in the filtrate from the clot. S. B. S.

The Occurrence of Proteose in Blood and Urine. L. Borchardt (*Zeitsch. physiol. Chem.*, 1908, **57**, 305—312).—If elastin is given in the food in fairly large amounts to dogs, a proteose (hemielastin) can be detected in the blood, and this is excreted by the kidneys and found in the urine. W. D. H.

Fatty Degeneration in the Blood. SAMUEL G. SHATTOCK and LEONARD S. DUDGEON (*Trans. Path. Soc. London*, 1907, **58**, 227—255).—In preparations of blood corpuscles hardened in formaldehyde, and stained with Scarlet [? Scarlet R], it is contended that stained particles in the leucocytes in various cases of disease indicate the occurrence of fatty degeneration. W. D. H.

Estimation of Catalases and Oxydases in Blood. II. WALTHER LÖB and PAUL MULZER (*Biochem. Zeitsch.*, 1908, **13**, 475—495.)—The rate of oxygen evolution was estimated both by the volume and pressure methods already discribed (this vol., ii, 999). The rate of reaction depends on the quantity of blood added. The curves representing the rate of gas evolution show with small quantities of blood a gradual rise. In the presence of larger quantities, the gradual rise is preceded by a sharper one. The velocity constant is not the same as that of the hæmase studied by Senter, and, from the complexity of the reaction, it is possible that more than one enzyme takes part in the reaction. The rate of action varies with the blood of different animals (rabbits). The action of various oxygen depolarisers was studied. Benzidine, formaldehyde, and salicylic acid are readily oxidised, but not alcohol.
S. B. S.

The Regulation of the Physico-chemical Properties of the Blood after Injection of Different Solutions. GIUSEPPE BUGLIA (*Biochem. Zeitsch.*, 1908, **13**, 400—439).—Hypertonic, isotonic, and hypotonic saline and sucrose solutions were injected into dogs, and certain quantities of blood were withdrawn from the animals both before and at different intervals after the injections. Determinations were made of the conductivity and viscosity of the serum, the molecular concentration of the defibrinated blood (by lowering of freezing-point method), and the volume of the corpuscles (by the hæmatocrite). Injections of hypertonic sodium chloride solutions were found to increase the molecular concentration of the blood and conductivity of the serum over a relatively long period, whereas they caused only a very temporary dilution of the blood volume. The changes produced by hypertonic sucrose solutions were only of temporary character, and disappeared much more quickly than those produced by sodium chloride. Isotonic solutions produced but slight changes, and so also did strongly hypotonic solutions, when the volume of the injected liquid and the rate of injection were not great. If, however, the quantity of the fluid and the rate of injection is sufficiently great to produce marked changes in the blood elements, then the physico-chemical changes are demonstrable. S. B. S.

The Influence of Alkaline Ferro- and Ferri-cyanides on Blood-coagulation. J. LARGUIER DES BANCELS (*Compt. rend.*, 1908, **147**, 266—268).—Both potassium ferro- and ferri-cyanides have a marked inhibitory action on the coagulation of the blood and of fibrinogen solutions, the latter acting more powerfully than the former, although it gives no precipitate with soluble calcium salts, whereas the former does. It is suggested that multivalent negative ions inhibit the coagulation of negative colloids. S. B. S.

Hæmolytic Poisons, especially Bile Salts and Soaps. F. NEUFELD and HÄNDEL (*Chem. Zentr.*, 1908, ii, 891—892; from *Arb. Kais. Gesundh. Amt.*, 1908, **28**, 572—584).—This is a study of the corpuscle-dissolving action of sodium taurocholate, soaps, and potassium hydroxide in comparison with other blood poisons, also of the action of hæmolytic agents on lipoids and proteins, so that their action on the cell-membrane and their destructive action on the whole corpuscle may be distinguished. Lecithin is soluble in a 10% solution of sodium taurocholate, but not in normal potassium hydroxide, or in a 1% solution of an oleate. Cholesterol crystals are soluble in none of these solutions, nor in sapotoxin. The taurocholate dissolves protein. In emulsions of olive oil in physiological salt solution, partly with lecithin and partly with egg-white, the addition of sodium taurocholate produces the liberation of fat, and the solution of lecithin and protein; the other materials used do not produce this effect.

In high concentrations, sodium taurocholate produces in the blood of sheep, goat, and ox an inhibition of hæmolysis, which in lower concentration rises as the concentration increases to an optimum. These three sorts of blood are peculiar in that they are refractory to pure cobra venom; the venom acts hæmolytically in the presence of lecithin. Other kinds of blood (guinea-pig, horse, hen) never show any inhibition unless physiological salt solution is replaced by an isotonic solution of sucrose.

Sodium taurocholate and a series of other hæmolytic agents are capable of uniting with complement, but this is not the case with all blood poisons; it depends on what constituent of the stroma or serum the poison is united to. In the case of sapotoxin, there is, for instance, no union with complement. The destruction of pneumococci by bile salts is also described, so also is "phagocytosis by emulsified fat droplets and the influence of specific anti-sera thereon."

W. D. H.

Hæmolysis. LÉO VON LIEBERMANN (*Biochem. Zeitsch.*, 1908, **13**, 363—364. Compare Abstr., 1907, ii, 973).—In order to produce hæmolysis of the corpuscles of pig's blood, 0·05 c.c. of pure oleic acid, and not oleic acid emulsion, as stated in the previous paper, should be added to 10 c.c. of pig's serum. There is also an error in the same place, as to the order in which different substances should be added to produce hæmolysis. S. B. S.

Bactericidal Action of Normal Serum. ROBERT MUIR and CARL HAMILTON BROWNING (*J. Pathol. Bacteriol.*, 1908, **13**, 76—91).—A distinction is drawn between absorption of complement by bacteria and the bactericidal effect which may follow. Treatment of a normal serum with increasing amounts of a dead emulsion of a bacterium usually produces first a diminution of its bactericidal action on that bacterium, then for that on other bacteria, and finally a diminution of the hæmolytic complement. This shows there is in serum a substance (bacteriophilic complement) with an affinity for bacteria in general. If the bactericidal action has been reduced as indicated above, it can be more than restored by adding a little of the homologous immune substance. W. D. H.

Digestion of Fat. III. S. A. Levites (*Zeitsch. physiol. Chem.*, 1908, **57**, 46—48. Compare Abstr., 1907, ii, 891)—The glycerol constituent of fat is rapidly absorbed. Absorption begins in the duodenum, and is completed in the neighbourhood of the cæcum. In the estimation of glycerol in the intestinal contents, the method of Shukoff and Schestakoff, which depends on the solubility of glycerol in acetone, gives results which are too high. Lewkowitsch's acetin method is better. W. D. H.

Nutritive Value of Plant Amides. Ernst Schulze (*Zeitsch. physiol. Chem.*, 1908, **57**, 67—73).—A critical review of the difference of opinion which has arisen between Lehmann, on the one hand, and Morgen and Henriques and Hansen, on the other, with reference to the nutritive value of asparagine and similar amides. W. D. H.

Ferments of Nuclein Metabolism. Alfred Schittenhelm (*Zeitsch. physiol. Chem.*, 1908, **57**, 21—27. Compare Abstr., 1907, ii, 109, 564).—Previous work by the author (and by W. Jones) has shown that the formation of uric acid from nuclein is due to a succession of ferment actions. It is now shown that these ferments can be precipitated from organ-extracts by alcohol or by ammonium sulphate, and these ferments, when acting on pure guanine, resolve it quantitatively into uric acid; under favourable conditions, the time may be as short as one to two hours. Bacterial action, which some authors lay stress on, is not the cause of the change. W. D. H.

Chemistry of Digestion. XXVI. The Behaviour of Different Proteins in the Stomach and Upper Duodenum of the Dog. E. S. London and W. W. Polowzowa (*Zeitsch. physiol. Chem.*, 1908, **57**, 113—130. Compare this vol., ii, 870).—Various proteins of animal and vegetable origin are not absorbed in the stomach. Proteins from serum and egg-white are difficult of digestion in the stomach, but most others are rendered soluble to the extent of 78%, the proportion between proteoses, peptones, and residual substances being 59·3, 32·9, 7·8. The juices in the first part of the duodenum act immediately on the soluble products of gastric digestion, resolving them into ultimate cleavage products, whereas the undissolved substances in the chyme are not attacked for some time. The first 6 or 7 centimetres of the duodenum absorb about 6% of the protein. W. D. H.

Absorption of Protein. Kornél von Körösy (*Zeitsch. physiol. Chem.*, 1908, **57**, 267—287).—The view is advanced that the cleavage products of protein digestion cannot be detected in the circulating blood; the percentage of protein in the blood is, however, increased, although whether protein synthesis occurs in the intestinal wall or in the blood itself is unsettled. The non-coagulable nitrogen in the blood is not increased, as stated by Cathcart and Leathes. W. D. H.

Muscular Activity and Protein Metabolism. PHILIP A. SHAFFER (*Amer. J. Physiol.*, 1908, **22**, 445—455).—The experiments made on two men, and given with full details, showed a rise of total nitrogen excreted in one, and a fall in the other, with muscular work. Work within physiological limits has *per se* no effect on protein metabolism as indicated by the nitrogen and sulphur of the urine. The excretion of uric acid, urea, ammonia, and creatinine is wholly unaffected.
W. D. H.

The Value of Protein Cleavage Products in the Animal Organism. VII. EMIL ABDERHALDEN and JOSEF OLINGER (*Zeitsch. physiol. Chem.*, 1908, **57**, 74—79. Compare this vol., ii, 51).—The present experiments on a dog fed with the final cleavage products of casein and meat, confirm results recorded previously that such substances are capable of maintaining weight and nitrogenous equilibrium. W. D. H.

The Influence of Nitrogen-free Sources of Energy on the Rate of Protein Decomposition by the Organism. W. FALTA and A. GIGON (*Biochem. Zeitsch.*, 1908, **13**, 267—273).—Dogs of similar size were fed on a standard diet for a time, and then allowed to fast for various periods. They were then given diets consisting, in one set of experiments, of meat alone; in another, of a mixture of meat and lævulose; in another, of meat and inosite, and in a fourth set, of meat and alcohol. It was found that the longer the period of fasting before administration of the meal the more rapid the protein decomposition (as estimated by the nitrogen excreted), and the less the protein-sparing action of the carbohydrate when this formed part of the food. The addition of inosite only slows the rate of protein decomposition during the first twelve hours. The time of the fast before the meal has no influence on the action of inosite. Alcohol accelerates the rate of protein decomposition. There is a tendency in the organism to replenish the glycogen stores which had become depleted by fasting, and this is done by obtaining the carbohydrate entirely from the protein when no other glycogen-former is ingested; hence, after fasting, the rapid degradation of protein. The carbohydrate store in the organism has therefore great influence on the time of decomposition. Experiments were also carried out on the effect of superposing various extra diets on a standard diet. It was found that the composition of the standard diet exerts considerable influence on the time of decomposition of the superposed diets.
S. B. S.

The Influence of Nitrogen-free Sources of Energy on the Rate of Protein Decomposition by the Organism. G. A. PARI (*Biochem. Zeitsch.*, 1908, **13**, 274—280).—The experiments were similar in character to those of Falta and Gigon (see preceding abstract). The effects of the addition of carbohydrates other than lævulose and of fat, on the rate of protein decomposition after a fast, were investigated. It was found that after a long fast, sucrose no longer has the power of slowing the rate of protein decomposition. Fat and β-hydroxybutyric acid, which are not glycogen formers, do not lose, however, their power to retard the rate of decomposition. S. B. S.

The Influence of the Thyroid Gland on the Rate of Decomposition. G. A. Pari (*Biochem. Zeitsch.*, 1908, **13**, 281—284).—Eppinger, Falta, and Rudinger have shown that in dogs without thyroid glands, the protein metabolised during fasting is less, and can be but little diminished by carbohydrates or fat, in contrast to what happens in the normal starving animal. The latter fact is attributed, from other factors discovered, to the depression of carbohydrate metabolism in animals deprived of the thyroid. To throw further light on this matter, experiments similar to those recorded in the preceding abstracts were carried out with animals deprived of the thyroid, which received meals of meat, with or without addition of other food-stuffs, after a period of fasting, and the rate of protein decomposition was determined by estimating the rate of nitrogen excretion. In the normal animal, the influence of carbohydrates on the retardation of the decomposition of protein is diminished by longer periods of fasting. In thyroidectomised animals, long periods of fasting do not diminish this delaying influence to anything like the same extent. S. B. S.

Influence of Thyroidectomy and Thyroid Feeding on Intermediary Metabolism. Frank P. Underhill and Tadasu Saiki (*J. Biol. Chem.*, 1908, **5**, 225—242).—After complete thyroidectomy and parathyroidectomy in dogs, the urinary ammonia is increased beyond what is observed in inanition. The nitrogen in the form of creatinine, purine, and allantoin is unaltered, but creatine is found in the urine. These dogs are incapable of utilising dextrose introduced subcutaneously to anything like the same degree as normal dogs can. The loss of the glands may thus cause a change in gaseous metabolism similar to that seen in cretinism. If normal dogs are fed on thyroid, the urinary nitrogen is increased; there is also a larger output of purine-nitrogen, and a low output of phosphorus. There is, however, but little change in the inter-relation of the urinary nitrogenous constituents.

There is no choline in the blood after thyroidectomy. W. D. H.

The Utilisation of the Energy of Provender as Influenced by the Temperature of the Surroundings, and the Nutritional Condition of Rabbits. W. Ustjanzeff and G. Bogajewsky (*Biochem. Zeitsch.*, 1908, **13**, 365—399).—Rabbits were fed for a preliminary period on a given diet which was insufficient for the energy needs of the organism. The carbon and nitrogen content, and also the calorific value of this diet and of the excreta, were estimated, and from these data, the loss from the body of fat and protein calculated, and also the calorific value of this loss. The same animal was then given the like diet with the addition of hay, and the same data obtained as in the preliminary period. From the two sets of data, the physiological food value of the hay was calculated. Experiments were carried out with animals in varying conditions of nutrition, and with the surrounding atmosphere at varying temperatures (0°, 20°, and 30°). It was found that Rübner's law of isodynamic replacement holds good if hay is used as provender, when the physiologically available energy of the latter is only about half of the total energy needs of the animal, and when the animal is kept in an atmosphere of low temperature. S. B. S.

Secretin. OTTO VON FÜRTH and CARL SCHWARZ (*Pflüger's Archiv*, 1908, **124**, 427—446).—Extracts of intestinal mucous membrane, prepared according to the method of Bayliss and Starling, contain choline. Choline stimulates pancreatic activity, and this action is antagonised by atropine. The secretin of Bayliss and Starling is a mixture of several substances, among which choline occurs. The effect of secretin is not abolished, but only lessened, by atropine.

W. D. H.

Oxidation Processes in Echinoderm Eggs. OTTO WARBURG (*Zeitsch. physiol. Chem.*, 1908, **57**, 1—16).—The research deals with the respiratory process, measured by the amount of oxygen used, in the eggs of *Arbacia pustulosa.* The figures given show (1) that the amount of oxygen used is from six to seven times greater in fertilised than in unfertilised eggs; (2) this is not mainly used in nuclear division, for at the stage when thirty-two cells are present, the use of oxygen is not proportionately increased from the stage when eight cells are present; (3) moreover, if the continuance of cell division is hindered by hypertonic sea-water, the amount of oxygen used is not markedly altered; (4) an egg-cell breathes 500 (± 100) times more vigorously than a sperm cell; (5) hypertonic solutions increase the use of oxygen in unfertilised eggs ten-fold; (6) a transference from hypertonic to normal sea-water also leads to an increase, but not such a marked one; (7) the temperature-coefficient shows the process to be a chemical one. W. D. H.

A Mono-amino-diphosphatide in Egg-Yolk. HUGH MACLEAN (*Zeitsch. physiol. Chem.*, 1908, **57**, 304).—A mono-amino-diphosphatide (P : N = 2 : 1) analogous to Erlandsen's cuorin, which he separated from heart muscle, can be separated from egg-yolk. W. D. H.

A Globulin from the Egg-Yolk of Squalus acanthias. CARL L. ALSBERG and E. D. CLARK (*J. Biol. Chem.*, 1908, **5**, 243—246).—The egg-yolk of the spiny dogfish contains no vitellin, but in its place, a globulin (or a mixture of globulins) which does not contain phosphorus, and, probably, iron is also absent. W. D. H.

The Assimilation of Phosphorus and Calcium during the Embryonic Life of the Chick. EM. CARPIAUX (*Bull. Acad. roy. Belg.* 1908, 283—295).—Analyses were made of the inorganic and lecithin-phosphorus and of the calcium in eggs in different stages of development. It was found that the chick during embryonic life uses chiefly the phosphorus in the egg itself, and if it utilises that of the shell at all, it does so only to a very limited extent. The shell furnishes four-fifths of the calcium necessary for the formation of the chick, and towards the end of the incubation period considerable use is made of this calcium. At this period, destruction of the lecithin takes place, which proceeds *pari passu* with the utilisation of the lime. S. B. S.

The Peroxydases of Animal Tissues. FR. BATTELLI and MLLE. L. STERN (*Biochem. Zeitsch.*, 1908, **13**, 44—88).—Tissue extracts possess the capacity of increasing the rate of oxidation of hydriodic acid by means of hydrogen peroxide. The reaction is manifested when carried out in the presence of starch. In the cases of most tissues, the reaction is masked by the presence of a catalase, which causes a too rapid destruction of the peroxide. If, however, ethyl hydroperoxide is employed instead of hydrogen peroxide, the reaction can, in most cases, be demonstrated, for the catalase of the tissue does not act on this substance, which possesses a similar peroxydase reaction to hydrogen peroxide. Even when the former peroxide is employed, the results are uncertain, and this fact is probably due to the presence of the substances in the tissues, which react chemically with iodine and thus mask the iodine-starch reaction. A more suitable method of investigating the peroxide reaction of the tissues consists in estimating the amount of carbon dioxide evolved when tissue extracts are treated with ethyl hydroperoxide or hydrogen peroxide and formic acid. The oxidation which then takes place, can occur in acid solutions, under which condition the catalase action on hydrogen peroxide is considerably depressed. The following tissues were investigated, and are enumerated in order of the magnitude of their peroxydase content: liver, kidneys, spleen, lungs, pancreas, lymph glands, ox-muscle, brain, testicles, dog-muscle, thymus, suprarenals, thyroid, rabbits muscle. Blood is also rich in peroxydase. The optimum temperature of reaction in most cases is 38—40°, and the ferment is destroyed at 66° in neutral media and at 55° in acid or alkaline media. In the case of the blood, however, the reaction is much more energetic at 55—60°, and is in other respects anomalous. It is stated to contain a so-called pseudo-peroxydase in the pigment. The formaldehyde is also oxidised under the same conditions as formic acid, but not so energetically. Higher fatty acids, which *in vivo* are readily oxidised, do not cause evolution of carbon dioxide under the same conditions as formic acid does. For this reason, it is not yet possible to determine the exact biological functions of peroxydases. S. B. S.

Mode of Oxidation of Phenyl Derivatives of Fatty Acids in the Animal Organism. HENRY D. DAKIN (*J. Biol. Chem.*, 1908, **5**, 173—186).—The subcutaneous injection of sodium phenylbutyrate results in the excretion of phenaceturic acid and a small quantity of β-hydroxy-γ-phenylbutyric acid. No phenylacetone or phenylacetoacetic acid could be found.

If β-hydroxy-γ-phenylbutyric acid is given in the same way, phenaceturic acid is again excreted, and phenylacetone could not be detected.

Administration of phenylacetone results in the excretion of hippuric acid, phenylaceturic acid not being formed. The probable mode of oxidation of phenylbutyric acid in the body is therefore:

$$CH_2Ph\cdot CH_2\cdot CH_2\cdot CO_2H \longrightarrow CH_2Ph\cdot CH(OH)\cdot CH_2\cdot CO_2H \longrightarrow CH_2Ph\cdot CO\cdot CH_2\cdot CO_2H(?) \longrightarrow CH_2Ph\cdot CO_2H.$$

Phenylacetic acid is excreted as phenaceturic acid. The intermediate formation of ketones is probably confined to phenylbutyric and phenylpropionic acids, and is not a general reaction. In normal metabolism, probably only part of the butyric and phenylpropionic acids passes through the stage of acetone and acetophenone respectively.

Phenyl*iso*crotonic acid is excreted as phenaceturic acid.

$\beta\gamma$-Dihydroxyphenylbutyric acid is excreted as hippuric acid and a little β-hydroxyphenylbutyrolactone. Mandelic acid is not formed. Dihydroxyphenylbutyric acid therefore does not undergo β-oxidation, but oxidation takes place at the γ-carbon atom. Dihydroxyphenylbutyric acid is not a product of the catabolism of phenylbutyric acid.

Phenylacetone is readily identified by conversion into its *p*-nitrophenylhydrazone, which crystallises from alcohol or pyridine in sparingly soluble rosettes of platelets, melting at 145—145·5°.

W. D. H.

Chemistry of the Brains of Birds and Fishes. Alfred Argiris (*Zeitsch. physiol. Chem.*, 1908, **57**, 288—295).—Cerebron from human brain yields 21·83% of galactose; that from birds' brain, 21·75%. A crystalline substance corresponding with Thudichum's sphingosin was also obtained. The birds employed were hens and ducks. Fishes' (cod) brain yielded cholesterol, lecithin, jecorin, and so-called protagon. W. D. H.

The Chemical Composition of Peripheral Nerves. Fritz Falk (*Biochem. Zeitsch.*, 1908, **13**, 153—172).—Both medullated and non-medullated nerves were investigated (sciatic of man, and splenic nerves of ox). The dried medullated nerves were extracted consecutively with benzene, acetone, and ether; the ether-soluble fraction was treated with alcohol, and to the filtrate from the precipitate thus produced, ammoniacal lead acetate in alcohol was added and, after separation of the precipitate and excess of precipitant, alcoholic cadmium chloride solution. By means of the various solvents and precipitants, a series of fractions was obtained, which were partly identified with known substances. The benzene-soluble fraction consisted chiefly of ordinary fats; the acetone extract contained chiefly cholesterol (m. p. 145°); from the ethereal extract a cerebroside separated, and by the precipitation of this extract with alcohol, the cephalins. Ammoniacal lead acetate precipitated another product belonging to the group of cephalins (m. p. 174°). The cerebroside was identical with the cerebrone of Thierfelder (m. p. 209°). The cephalin (m. p. 174°) had the chemical composition of a mono-amino-monophosphatide; it could not be identified with the cephalins already described and obtained from the brain. Only a small quantity of cadmium chloride precipitate soluble in cold benzene was obtained, and the amount of lecithin appeared therefore to be small and to be accompanied by other phosphatides, which have not yet been identified. A quantitative separation of the various constituents of medullated and non-medullated nerves showed that the former contained 25% cholesterol, 12·4% cephalins, 18·2% cerebrosides, and 2·9% lecithin, whereas the latter contained 47% cholesterol, 23·7% cephalins, 6% cerebrosides, and 9·8% lecithin.

S. B. S.

Weigert's Method of Staining Medullated Nerve Fibres. J. Lorrain Smith, W. Mair, and Jocelyn F. Thorpe (*J. Pathol. Bacteriol.*, 1908, **13**, 14—27).—Weigert's method of hæmatoxylin staining, after treatment with potassium dichromate, depends, as osmic acid staining does, on the presence of an unsaturated grouping in the fatty matter present. Cholesterol by itself gives a negative result, although it contains an unsaturated grouping, but it forms myelin figures in contact with soap. These and the crystals described in tissues by C. P. White (composed of cholesterol and fatty acid) stain slowly by the Weigert method. Some results obtained with lecithin are attributed to cholesterol as an impurity in the lecithin used.

W. D. H.

Action of Curare and Physostigmine [Eserine] on Nerve-endings. Action of Barium Chloride on Bird's Muscle. Charles Wallis Edmund and George B. Roth (*Amer. J. Physiol.*, 1908, **23**, 28—45, 46—47).—The tonic contraction produced by nicotine in muscles is counteracted by curare; this antagonism is less marked if the nerves are cut, and, as a rule, this lessening of the antagonism coincides in data with the degeneration of the nerve-ending. This may be because denervated muscle has an increased sensitiveness towards nicotine, so that curare is unable to displace it. This view is upheld, and so curare is considered to act, not on the nerve-ending as usually taught, but on the muscle, or on some substance in the muscle of the nature of Langley's receptive substance. As a support to this view, experiments with eserine are recorded. This alkaloid acts in the same way as nicotine, only more slowly. It acts more quickly on denervated muscle, which, therefore, has an increased sensitiveness to it. Curare neutralises the effect whether the muscles are denervated or not. The tonic contraction produced by barium chloride is, however, not antagonised by curare under any circumstances.

W. D. H.

Chemico-physical Investigation of the Crystalline Lens. Filippo Bottazzi and Noè Scalinci (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 153—159).—The aqueous humour of the eye contains normally a very small proportion of protein, which is coagulable by heat, but has not the characters of the lenticular protein, and probably has its origin in the blood or lymph. The vitreous body resembles a sponge, the net-work of which consists of protein substances coagulable by heat, and contracts during coagulation, expressing the liquid contained in the alveoli. This liquid contains a small quantity of a substance precipitable by acetic acid and insoluble in excess of the acid, and is possibly identical with the coagulable protein found in the aqueous humour. Neglecting these small amounts of proteins, the ocular liquids may be regarded as aqueous solutions of crystalloids, mainly of sodium chloride. With regard to their chemical reaction, the ocular liquids behave like a solution of sodium hydrogen carbonate containing sufficient carbon dioxide to render it neutral to phenolphthalein. Excess of carbon dioxide in the ocular liquids renders them acid to phenolphthalein, and may result in the precipitation of the protein as alkali-protein and in the production of superficial opacity of the crystalline lens. T. H. P.

Amount of Choline in the Lecithin of Heart Muscle. Hugh MacLean (*Zeitsch. physiol. Chem.*, 1908, **57**, 296—303).—The lecithin of heart muscle when decomposed in aqueous or alcoholic solution yields, on the average, not more than 52% of its nitrogen in the form of choline. Whether a second nitrogenous product is also present is to be investigated. W. D. H.

Hydrolysis of Chicken Flesh. Thomas B. Osborne and Frederick W. Heyl (*Amer. J. Physiol.*, 1908, **22**, 433—439).—The entire muscle was used, the substances soluble in water, alcohol, and ether having been removed. The result of hydrolysis shows that the amino-acids occur in different proportions from those given previously by Abderhalden and Sasaki and by Hart in relation to the syntonin of ox flesh. It is, however, doubtful whether the analyses can be fairly compared, especially as the sum total of the products in one case is 60%, and in the other 47%, of the material employed. The most striking feature in the hydrolysis of chicken muscle is the high yield of lysine. W. D. H.

The Degradation of Acetoacetic Acid in the Animal Body. II. Gustav Embden and Louis Michaud (*Biochem. Zeitsch.*, 1908, **13**, 262—266).—It has been already shown that the liver tissue possesses the property of destroying acetoacetic acid. As the latter is excreted in cases of diabetes, experiments were carried out to determine whether this is due to increased production, or to the loss of capacity of the liver in diabetic individuals to destroy the acid, which is probably a normal intermediary metabolism product. For this purpose, experiments were made with the liver of dogs which had been rendered diabetic by the extirpation of the pancreas. Control experiments were carried out with the liver tissue of similar normal animals. It was found that the capacity for destroying acetoacetic acid was the same in the liver of the diabetic as in that of normal animals. The muscular tissue of diabetic animals also retained its property of destroying the acid.

S. B. S.

The Behaviour of Creatine in Autolysis. A. Rothmann (*Zeitsch. phsiol. Chem.*, 1908, **57**, 131—142. Compare Stangassinger, this vol., ii, 515).—According to Gottlieb and Stangassinger (Abstr., 1907, ii, 637), creatine and creatinine are destroyed or altered by ferment action during autolysis. Mellanby (this vol., ii, 308) finds, on the other hand, that this is not the case if bacteria are excluded. The present experiments undertaken with aseptic and antiseptic precautions confirm the results of the first-named authors.

W. D. H.

The Action of Arsenic on Autolysis. LEO HESS and PAUL SAXL (*Chem. Zentr.*, 1908, ii, 338; from *Zeitsch. exp. Path. Ther.*, 1908, **5**, 89—93).—The action of arsenic, even when highly dilute, is inhibitory towards the autolytic changes in organs (liver). This is designated negative catalysis. W. D. H.

The Occurrence of Choline in Thymus, Spleen, and Lymph Glands. CARL SCHWARZ and R. LEDERER (*Pflüger's Archiv*, 1908, **124**, 353—360).—The occurrence of choline in extracts of thymus, spleen, and lymph glands is proved by chemical and physiological tests. The effect that extracts of these organs have in lowering blood pressure is attributed mainly to choline. Other depressor substances present were not chemically identified, but the suggestion is made that they may belong to the group of histones. W. D. H.

The Depressor Substance in the Thyroid. OTTO VON FÜRTH and CARL SCHWARZ (*Pflüger's Archiv*, 1908, **124**, 361—368).—The substance present in thyroid extracts which depresses arterial pressure is identified as choline. W. D. H.

The Chemistry of Amyloid Degeneration. OLAV HANSSEN (*Biochem. Zeitsch.*, 1908, **13**, 185—197).—The amyloid tissue (the "sago granules" of the spleen) was separated from the surrounding tissue by a mechanical method. The product obtained in this way was, when dried, a yellow or brown powder, which gave the usual blue coloration with iodine after addition of sulphuric acid, and the ordinary protein reactions. The C : N ratio in three different preparations was constant (approximately 4); these contained no oxidised sulphur, and consequently no conjugated sulphuric acid, and the observation of previous observers, who noted the presence of chondroitinsulphuric acid, appears to be incorrect. The amyloid tissue is, in general, very resistant to the action of proteolytic ferments; it is changed, however, by the action of pepsin and hydrochloric acid into a product which is soluble in dilute ammonia, but which no longer gives the iodine reaction. The capacity to give this reaction is also lost on treatment of the tissue with alkalis.

Although the mechanically separated amyloid tissue itself contained no oxidised sulphur, the organs from which it had been obtained did. It seems probable that the chondroitinsulphuric acid or a similar substance is formed at the same time as the amyloid tissue. No other marked differences between amyloid and normal tissue were ascertained.

S. B. S.

So-called Fatty Degeneration of the Suprarenal. CHARLES POWELL WHITE (*J. Pathol. Bacteriol.*, 1908, **13**, 11—13).—The presence of fats and lipoids in the suprarenal cortex is a physiological condition. The cortex is believed to be engaged in the secretion of cholesterol, lecithin, and fats, and this has some connexion with the regulation of growth and development. W. D. H.

Silicic Acid in Whartonian Jelly. Franz Frauenberger (*Zeitsch. physiol. Chem.*, 1908, **57**, 17—20).—The amount of silicic acid in the Whartonian jelly of the human umbilical cord is less than Schulz stated it to be. According to Schulz, the ash contains 0·6% of the acid; the figure should be 0·028. W. D. H.

The Action of Electrolytes on the Rhythmic Movements of Medusæ. I. Action of the Salts of Sea-water. Albrecht Bethe (*Pflüger's Archiv.*, 1908, **124**, 541—578).—An investigation of the various salts, alone and in combination, on the movements of jelly fish was carried out on the lines of the well-known work of Loeb and others. The relative importance of the various ions is discussed. Thus sodium chloride by itself first stimulates and then paralyses the movements; this action is reversible; potassium stimulates the rhythm; magnesium paralyses it; the paralysing action of calcium only occurs when it is highly concentrated. W. D. H.

The Circulation of the Bile. Gustav Bayer (*Biochem. Zeitsch.*, 1908, **13**, 215—233).—Although the bile salts are strongly toxic to individual organs, they are being continually resorbed from the intestine and entering the circulation. They then exert no toxic effect, even in cases of jaundice. This is due to the fact that the salts are changed in some manner by the serum proteins, and are thereby deprived of their toxic character. This was confirmed by investigating the toxic action of bile salts, when alone and when mixed with serum, on muscular tissue, the central nervous system, the circulation, and also the haemolytic action. The change effected by serum on the bile salts which deprives them of their toxic character is probably of a physical nature ("colloidal envelopment"). Serum which has been previously warmed acts more efficiently in this respect than unwarmed serum. This action between serum proteins and bile salts produces a disappearance of the complement, a fact which was ascertained by allowing red blood corpuscles to act on amboceptor and complement containing sera in the presence of bile salts which had themselves been deprived of their hæmolytic action by means of an inactive serum. The change in the bile salt molecule wrought by the serum renders excretion difficult, and a bile salt thus changed will not readily dialyse. The liver cells exert a great affinity for the bile salts, and the fixation of cholates by these cells can be demonstrated *in vitro*. S. B. S.

Bile Hæmolysis. III. The Reasons of the Increased Rate of Bile Hæmolysis in Concentrated Salt Solutions. Gustav Bayer (*Biochem. Zeitsch.*, 1908, **13**, 234—242).—It was shown that bile salts diminish the surface tension of salt solutions to a greater extent than they do that of pure water. Substances which lower the surface tension of a solution tend to concentrate on the surface. The bile salts tend in emulsions of blood corpuscles to collect round the erythocytes, and the more rapidly the more concentrated the salt solution used as their solvent. In concentrated salt solutions, there is a more rapid entry therefore of the bile salts (which bring about hæmolysis by their action on the lipoids) than in water. S. B. S.

The Influence of Tolylene-2 : 4-diamine on the Secretion of Cholesterol in the Bile. Chasoburō Kusumoto (*Biochem. Zeitsch.*, 1908, **13**, 354—362).—The polycholia, following administration of tolylene-2 : 4-diamine, is stated to be due to the destruction of blood-corpuscles ; thus supplying material for bile pigment which is derived from hæmoglobin. As the corpuscles also contain cholesterol, it might be expected, therefore, that administration of tolylene-2 : 4-diamine would also lead to an increased elimination of this substance in the bile. This the author has experimentally shown to be the case. The experiments were carried out on dogs with biliary fistulæ. S. B. S.

Hæmolytic Factors in Milk. Janet E. Lane-Claypon (*J. Pathol. Bacteriol.*, 1908, **13**, 34—37).—Milk, when fresh, contains both complement and amboceptor in about 1/10 the strength of that in serum. In order to obtain hæmolysis, "ox-colloid" must be added ; this confirms Bordet's views. "Ox-colloid" is prepared by heating ox-serum to 56% for thirty minutes, and then removing the amboceptor by adding about twice the amount of corpuscles which it can sensitise. The mixture is incubated for one hour, and centrifuged ; the supernatant fluid is "ox-colloid."

On adding blood-corpuscles to milk, the cream picks them up and carries them to the top. This red plug does not occur if the milk has been previously heated for a few minutes to 70%, and this circumstance may be used to detect heated or pasteurised milk. W. D. H.

The Degree of Acidity of Urine. Adolf Jolles (*Biochem. Zeitsch.*, 1908, **13**, 177—184).—The concentration of the hydrogen ions was estimated by determining the rate of hydrolysis of sucrose caused by it at various temperatures. At higher temperatures, for example, at 90°, the results were complicated by the decomposition of the urea and the formation of ammonium carbonate. For this reason, the urea was estimated in the urine both before and after the process of inversion, as also the acidity (by titration) and the mono- and di-phosphates. The results indicated that the concentration of hydrogen ions is very small, and corresponds very closely with that due to monosodium phosphate present in the urine. Owing to the decomposition of urea, trustworthy results by sugar catalysis are only obtainable when the temperature of the experiment does not exceed 37°. S. B. S.

The Rate of Elimination of Chloroform. D. Noël Paton (*Proc. Roy. Soc. Edinburgh*, 1908, **28**, 472—496) ; D. Noël Paton and Dorothy E. Lindsay (*ibid.*, 497—502).—The experiments were performed on dogs and rabbits ; the blood and tissues, as well as the excreta, were examined, and the analytical results given in detail. It was found that when chloroform is given by the respiratory passages, it is first dissolved in the blood, and thus acts on the nerve-centres, excess being rapidly eliminated. If it is subcutaneously administered, and still more if given by the stomach, the assumption is slow, more stable compounds are formed, and elimination is consequently delayed. The drug has thus more time to produce a slow toxic effect upon the protoplasm of the tissues. The onset of late chloroform poisoning after anæsthesia is due to delayed elimination brought about by unusually firm fixation or by respiratory deficiency. W. D. H.

Excretion of Creatinine in Man. C. J. C. van Hoogenhuyze and H. Verploegh (*Zeitsch. physiol. Chem.*, 1908, **57**, 161—266. Compare Abstr., 1906, ii, 186).—An extensive series of estimations of creatinine are recorded in health and disease, which confirm, in the main, the conclusions drawn by Folin and other workers. Mellanby's view, that creatinine is converted into creatine in the liver, is confirmed, as is also the statement of Gottlieb and Stangassinger that substances (probably ferments) occur in the liver and other organs which transform creatine into creatinine. If the liver is largely destroyed (for instance, by cancer), large amounts of creatine instead of creatinine pass into the urine. The lowering of hepatic activity will explain the presence of creatine in the urine in fever and hunger. In the healthy tissues and blood, creatinine is never found, as it is removed so quickly by the kidneys. W. D. H.

Excretion of Creatine and Creatinine in Health and Disease. Philip Shaffer (*Amer. J. Physiol.*, 1908, **23**, 1—22).—Normally, from 7 to 11 mg. of creatinine nitrogen are excreted per kilo of body-weight. This is constant from day to day and from hour to hour; it is not influenced by the volume of the urine, or by the total nitrogen excreted. This creatinine coefficient is parallel to the muscular efficiency of the individual, and in many diseases it is lowered. Creatinine is not an index of total endogenous protein catabolism, but of some special process of normal muscular metabolism. Mellanby's view that the liver is the seat of its formation, whence it reaches the muscle, is dissented from. The creatinine excretion is slightly increased in acute fevers; here it is not parallel to muscular efficiency. Unless creatine occurs in the food, it is absent from normal urine; it may be excreted in acute fevers, in the acute stages of exophthalmic goitre, by women during involution of the uterus, and in other conditions in which there is a rapid loss of muscle protein. W. D. H.

Cystinuria with Diamines. Francis H. Thiele (*Trans. Path. Soc.*, 1907, **58**, 255—263).—A case of cystinuria is recorded; tyrosine and other mono-amino-acids were absent from the urine. The urine contained cystine, and, in addition, excess of neutral sulphur, and also cadaverine; putrescine was present in the fæces. All the cystine was apparently derived from tissue catabolism, since starvation, changes of diet, and administration of cystine made no difference in the amount excreted. The conclusion is drawn that the tissues were deficient in a ferment which normally removes sulphur from thio-amino-compounds.

W. D. H.

Diuresis. XV. Excretion of Sodium Chloride in Phloridzin Diabetes. JOH. BIBERFELD (*Pflüger's Archiv*, 1908, **124**, 532—540. Compare Abstr., 1906, ii, 564).—Polemical. A reply to Loewi and Neubauer on their criticisms of the author's previous work.

W. D. H.

Morphine Diabetes. W. SPITTA (*Chem. Zentr.*, 1908, ii, 343; from *Zeitsch. exp. Path. Ther.*, 1908, **5**, 94—104).—The reducing substance often found in the urine of those dosed with morphine is probably lævulose, although it is stated to be optically inactive. Dextrose, glycuronic acid, and pentose are absent. W. D. H.

Gout. HEINRICH KIONKA (*Chem. Zentr.*, 1908, ii, 342; from *Zeitsch. exp. Path. Ther.*, 1908, **5**, 131—141, 142—146).—After the administration of uric urid, glycine can be detected in the blood. A crystalline derivative of it, naphthalenesulphonylglycine, was prepared, which showed all the crystallographic constants of the same substance prepared synthetically. A crystallographic description is also given of the corresponding derivatives of other amino-acids (leucine, alanine, &c.).

Feebly alkaline solutions of glycine, alanine, leucine, and allantoin catalytically accelerate the precipitation of acid urates from solutions of uric acid. The presence of such substances in gout is therefore harmful. W. D. H.

High Temperatures and Heat Stroke. HARVEY SUTTON (*J. Pathol. Bacteriol.*, 1908, **13**, 62—73).—In the human subject, the rise of internal temperature, due to exposure to high external temperature, is accompanied by a marked rise in total respiratory exchange and a rise in the respiratory quotient; this probably points to a greatly increased combustion of carbohydrates. W. D. H.

Crystals in Tumours. CHARLES POWELL WHITE (*J. Pathol. Bacteriol.*, 1908, **13**, 3—11).—Crystals consisting of a loose combination of cholesterol with fatty acids, lecithin, or other substances occur in or among the cells of malignant tumours and in some other conditions. These crystals appear to be associated with cell proliferation rather than with degeneration. In degenerated areas, the crystals formed are mostly either cholesterol, fatty acids, or fats. It is suggested that cholesterol is associated with the regulations of cell proliferation.

W. D. H.

Peptonisation in Raw and Pasteurised Milk. RACHEL H. COLWELL and HENRY C. SHERMAN (*J. Biol. Chem.*, 1908, **5**, 247—252).—The conclusion is drawn that pasteurisation is not an ideal process as a safeguard against infectious disease. Heating may destroy acid-producing organisms, but leaves intact putrefactive, ammonia-forming, and peptonising organisms. Pasteurisation at high temperatures (75—90°)

has less restraining effect on peptonisation and development of offensive odours than heating to 60°. The amount of ammonia does not always run parallel with intensity of the putrid odour. The determinations of intensity of odour, and also of peptone by the biuret reaction are admittedly rough, and, although conclusions are drawn in reference to infectious disease, no experiments or observations on pathogenic organisms appear to have been made. W. H. D.

Action of Wines and of Alcohols on the Frog. VITTORIO NAZARI (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 166—172).—In small doses, alcohols have no apparent physiological action on frogs, but in larger doses they produce narcosis or complete muscular relaxation, which lasts a longer or shorter time according to the concentration of the alcohol employed and to the size of the frog. Complete recovery takes place from this narcosis, but larger doses of the alcohols cause death. In the following list, the alcohols examined are arranged in the order of increasing narcotic power: ethyl, methyl, propyl, *iso*butyl, *iso*amyl, amyl. The alcoholic content of a wine can be determined roughly by ascertaining at what dilution it just causes or fails to cause narcosis, 1 c.c. of 4% ethyl alcohol having no narcotic influence even on small frogs; in this connexion, the presence in the wines of small proportions of highly narcotic higher alcohols must be borne in mind. T. H. P.

The Mechanism of the Action of Arsenic Preparations on Trypanosomes in the Animal Organism. II. MARTIN JACOBY and ALBERT SCHÜTZE (*Biochem. Zeitsch.*, 1908, 13, 285—298). —Mice received injections of atoxyl, or of arsenious acid, and were then inoculated with Nagana trypanosomes. The trypanosomes from these animals were then inoculated into other animals similarly treated. This process of transference from animal to animal which had been injected with atoxyl or arsenious acid was repeated several times, and the sensitiveness of the trypanosomes obtained after many animals had been thus inoculated towards both arsenious acid and atoxyl was investigated, the experiments being carried out *in vitro*. No marked difference in this respect between these and normal trypanosomes could be ascertained. S. B. S.

The Behaviour of Iron Arseno-paranucleate and of Arsenious Acid in the Organism. ERNST SALKOWSKI (*Biochem. Zeitsch.*, 1908, 13, 321—338).—The arseno-paranucleate was obtained by precipitating an arsenical peptic digestion product of caseinogen by ferric ammonium sulphate. There is evidence that the product obtained in this way is a definite compound, and not a mixture of ferric arsenate and paranucleate. Its behaviour in the organism was investigated by examining the urine after its administration, and determining the rate and the form of the arsenic excretion. It was found that if alcohol is added to alkaline urine, the arsenic in inorganic form is precipitated, whereas that in organic combination dissolves in alcohol. Iron arseno-paranucleate is readily resorbed from the digestive tract, a fact which confirms the assumption that the arseno-paranucleate is a definite compound, for arsenate of iron is not readily resorbed. The arsenic excreted is chiefly in the form of an organic compound, although small quantities of inorganic arsenic can be detected in the urine in the first days after the administration. The arseno-paranucleate is also resorbed after subcutaneous injection. After administration of arsenious acid, both organic and inorganic arsenic is excreted, the former being in excess of the latter. Of ingested arsenious acid, at least 62% is excreted in the urine after six days. In some experiments, arsenic was detected in the urine of animals to which no arsenic compound had been directly administered; this is due to the small arsenic content of certain vegetables which served as food.

S. B. S.

Physiological Action of Choline. Georg Modrakowski (*Pflüger's Archiv*, 1908, **124**, 601—632).—This alkaloid appears to be less toxic than is usually considered to be the case. Many of the physiological effects, including the lowering of blood-pressure, usually attributed to it occur only in commercial specimens, but not in the pure substance. The action of the impurity is antagonised by atropine; hence it is that commercial choline produces, after atropinisation, a rise of blood-pressure, which is always the result if the pure alkaloid is employed. Pure specimens rapidly develop the impurity. The experiments were made with choline synthetically prepared.

W. D. H.

The Behaviour of the Brain towards Strychnine. Torata Sano (*Pflüger's Archiv*, 1908, **124**, 369—380).—The grey cortex of the human brain neutralises the toxic action of strychnine; this is especially marked in the motor areas, and the action is attributed in the main to the giant pyramid cells. W. D. H.

Action of Strychnine and Caffeine. Torata Sano (*Pflüger's Archiv*, 1908, **124**, 381—391).—From experiments on frogs, the conclusion is drawn that strychnine has an anæsthetic as well as a stimulating action; the former manifests itself mainly on the pain receptive elements of the central nervous system, and the latter on the tactile elements; the stimulating action outlasts the anæsthetic, and is slower of development. Similar conclusions are drawn regarding the action of caffeine. W. D. H.

The Liver in Chloroform Necrosis (Delayed Chloroform Poisoning). H. Gideon Wells (*J. Biol. Chem.*, 1908, **5**, 129—146).—Rapid autolysis of the liver cells sometimes follows chloroform anæsthesia in man. A third or more of the solids may disappear in a few days, and the liver contains proteoses, purine bases, polypeptides, and amino-acids. The sulphur in insoluble form is unaltered, but, in spite of loss of nuclear structure, the insoluble phosphorus is increased. The distribution of nitrogen in mono- and di-amino-acids in the coagulated liver proteins does not differ from the normal. Fatty metamorphosis is present in moderate degree; the increase in ether extractives is due to infiltration with simple fats; the lecithin is slightly decreased, and the amount of cholesterol unaltered. There is less replacement of proteins by water, and more fatty infiltration than in acute yellow atrophy. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

The Chemical Changes Involved in the Assimilation of Free Nitrogen by Azotobacter and Radiobacter. JULIUS STOKLASA [with ADOLF ERNEST, FRANZ STRAŇÁK and EUGEN VÍTEK] (*Centr. Bakt. Par.*, 1908, **21**, ii, 620. Compare this vol., ii, 880).—The activity of the culture decreases as it ages, doubtless because of the accumulation of acid. Quantitative experiments made to trace the fate of the dextrose were only partly successful; starting with 15·9 grams of dextrose, 7·9 were converted into carbon dioxide, 0·3 into ethyl alcohol, 0·2 into formic acid, 0·7 into acetic acid, 0·2 into lactic acid, leaving a balance of 6·5 unaccounted for, part of which, however, is assimilated into the cell wall of the organisms.

Contrary to the statements of Severin and Krzemieniewski, hydrogen is invariably liberated, and, if sodium nitrate has been added, a certain amount of nitrite and of ammonia is produced.

The author has made an analysis of the bacterial mass and found N 11·3% and ash 8·6%; the latter contained P_2O_5 4·9, and K_2O 2·4, these two substances forming practically the whole of the ash.

E. J. R.

Fixation of Atmospheric Nitrogen by Pure Cultures of Azotobacter. Distribution of the Organism. MARTINUS W. BEYERINCK (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 67—74. Compare Stoklasa, this vol., ii, 880).—The author supposed previously that the active agent in nitrogen fixation is not *Azotobacter*, but *Bacillus radiobacter*, almost invariably found with it. His subsequent experiments have demonstrated the incorrectness of this view, and it is now clear that *Azotobacter* fixes nitrogen. The present paper deals with an improvement in technique, whereby it is possible to obtain a better idea than formerly of the distribution of the organism.

It is customary to use a sugar as the source of carbon in culture solutions, but the author finds that calcium malate is better; his solution was 100 tap water, 2 calcium malate, 0·05 K_2HPO_4. Plates can be made if 1 to 2 parts of agar agar are also added; on these, a larger number of organisms develop into colonies than on any other plates, so that a more exact estimate of the number of *Azotobacter* present in a sample of soil can now be made. Instead of calcium malate, the lactate, acetate, or propionate can also be used, but in these media the organisms soon lose their power of growth, and re-inoculation to obtain pure cultures cannot be continued for long. Growth is also slow when calcium citrate, tartrate, or succinate is used, and there is no growth when calcium glycollate is supplied.

The amount of nitrogen fixed per gram of calcium salt oxidised was 4·9 mg. with the propionate, 2·8 mg. with the acetate, 2·6 mg. with the malate, and 1·8 mg. with the lactate. About 7 mg. are fixed for each gram of sugar oxidised when sugar is used as the source of carbon.

When calcium malate plate cultures are made of soil extracts, it is not usual to find colonies of *Azotobacter*, because only a small proportion survive and develop on plates, but when soil adhering to the roots of leguminous plants is examined, a number of colonies are produced, showing that a distinct relationship exists between the distribution of *Azotobacter* and the *Leguminosæ*. E. J. R.

Variation of the Rate of Disinfection with Change in the Concentration of the Disinfectant. HERBERT EDMESTON WATSON (*J. Hygiene*, 1908, **8**, 536—542).—Miss Chick's results on the laws of disinfection, in which she showed that the disinfection is strictly analogous to a chemical reaction in which individual bacteria play the part of molecules, can be expressed by a mathematical formula, the use of which is illustrated by one of the problems worked out as follows: A solution of phenol containing 10 parts per 1000 disinfects a culture of *Bacillus paratyphosus* in twenty-five minutes; another solution takes thirty-five minutes. What is the strength of the second solution? Let the strength of the second solution be x; for phenol, $n = 5·5$. Therefore $5·5 \log 10 + \log 25 = \text{constant} = 5·5 \log x + \log 35$. From this $x = 9·4$. W. D. H.

Protein Formation in Ripening Seeds. N. WASSILIEF (*Ber. deut. bot. Ges.*, 1908, **26a**, 454—467. Compare Abstr., 1901, ii, 185, and Nedokutschaeff, Abstr., 1902, ii, 281; 1903, ii, 508; Zaleski, 1905, ii, 549).—A continuation of work on the source and method of formation of protein in ripening seeds. As the result of a series of determinations, the amounts of nitrogen present in various forms, for example, as protein, asparagine, amino-acids, substances precipitated by phosphotungstic acid, &c., in (1) seeds at various stages of ripeness, (2) whole fruits, (3) husks of fruits, (4) whole leaves, (5) laminæ, and (6) petioles, of *Lupinus albus*, the following principal conclusions are drawn.

After the removal of fruits from the plants, protein formation takes place in the former whether they are kept in the dark or in the light, and at the expense of asparagine, present in the fruit as plucked. The amino-acids at first increase slightly in amount, especially if the fruits are kept in the dark, doubtless as the result of protein decomposition, but eventually they are also used up, being probably transformed into asparagine, and then into protein. Organic bases play much the same rôle as amino-acids.

In the foregoing changes, the seeds become gradually richer in nitrogenous material, due to movement of nitrogenous substances from the husks of the fruits to the seeds. At the same time, the seeds become enriched with protein at the expense of the husks, so that the protein of the ripe seeds is, in part, derived from amino-compounds initially present in them when the fruits are plucked, and, in part, from amino-compounds subsequently formed in the husks. Seeds separated from the husks, and kept either dry or damp, form some protein from asparagine and other amino-compounds originally present in them. T. A. H.

The Rapid Change in Composition of Certain Tropical Fruits during Ripening. H. C. Prinsen Geerligs (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 74—84).—The fruits investigated are commonly gathered in an immature state; within a few days they become tender and palatable; a few days later, however, they become over-ripe, and change to a soft, unpalatable mass. Experiments with bananas (*Musa*) showed that during the ripening process there is an evolution of carbon dioxide and water, and a considerable conversion of starch into sugar. The composition at the various stages is as follows:

	April 17, unripe.	April 19.	April 20.	April 22.	April 23, ripe.	April 24, over-ripe.
Dry matter, per cent...	41·76	40·79	40·52	40·14	39·02	38·88
Starch...	30·98	24·98	20·52	13·80	9·59	7·68
Sucrose...	0·86	4·43	6·53	10·50	13·68	10·36
Dextrose...	0·25	0·96	1·80	3·18	4·72	6·1
Lævulose...		0·90	1·53	2·70	3·61	4·8

Quite similar results were obtained with the mango (*Mangifera*) and the tamarind (*Tamarindus*).

Oxygen is necessary for the ripening process; bananas will keep their starch intact if surrounded with an atmosphere of nitrogen. The author, therefore, considers sugar production to be a vital process, although he succeeded in demonstrating the presence of an enzyme capable of decomposing starch.

Sapodilla (*Achras sapota*) does not fall into line with the above-mentioned fruits; the amount of sugar before and after ripening remains unaltered, and the change appears to be mainly a softening of the hard pectin, and a deposition of tannin and gutta-percha from the juice as insoluble substances. E. J. R.

Vegetable Phosphatides. Ernst Schulze (*Chem. Zeit.*, 1908, **32**, 981—983. Compare this vol., i, 385).—Phosphatides were determined in a number of seeds (without husks), and the following results obtained (percentages in dry matter):

	Phosphorus.		
	Total per cent.	Per cent. in ether-alcohol.	Phosphatides as lecithin.
Yellow lupins...	—	0·082	2·14
Blue ,, ...	1·53	0·084	2·19
Garden beans...	1·32	0·049	1·27
Phaseolus multiflora...	—	0·035	0·90
Sunflower...	—	0·017	0·44
Pepo cucurbita...	2·10	0·021	0·55
Ricinus...	1·14	0·011	0·29
Beech...	—	0·011	0·30
Chestnut...	—	0·026	0·67
Horse chestnut...	—	0·026	0·67
Pinus cembra...	1·16	0·038	0·99
Pinus maritima...	2·60	0·033	0·86

The phosphatide represents only a small percentage of the total phosphorus (in the case of *Ricinus*, only 1%), and, since the seeds contain very little inorganic phosphorus, it is evident that some other organic phosphorus compounds must be present in much larger quantity than the phosphatides. The substance known as phytin, which yields inositol as a cleavage product, is one of these substances, and is presumably of greater importance to plants than the phosphatides.
N. H. J. M.

Water-soluble Polysaccharides of Barley and Malt. Horace T. Brown (*Bied. Zentr.*, 1908, **37**, 675—676; from *Zeitsch. ges. Brauwesen*, 1907, **30**, 286).—Finely-crushed barley (1 kilo.) was stirred with boiling water (7 litres), cooled to 70°, and, after adding 15 c.c. of malt extract, boiled for a long time. A further amount (250 c.c.) of malt extract was then added, and the whole digested for one hour at 50—55° and again boiled. It was then filtered, the residue well washed with hot water, and the filtrate evaporated to 4 litres under reduced pressure. The resulting liquid, D. 1·060, containing 15% of dry matter, was treated with 80% alcohol; on cooling, white flakes of crude amylan separated. The latter, after being thoroughly washed with 60—70% alcohol, was treated with 500 c.c. of water, and again precipitated with alcohol.

The soluble constituents of barley are as follows: ash, 0·75; proteins, 0·75; sugar, 4·10; starch, 56·20, and amylan, 9·65%. The amylan yields, when hydrolysed with 2·5% oxalic acid, chiefly dextrose along with galactose, mannose, arabinose, and xylose.

Crude amylan from malt dissolves readily in cold water, is strongly dextrorotatory, and has slightly reducing properties. When hydrolysed, it yields dextrose and arabinose. N. H. J. M.

Fruits of Caulophyllum thalictroides and Cornus sericea. Edith Stockton and C. G. Eldredge (*Chem. News*, 1908, **98**, 190—191).—The pulp of the fruit of *Caulophyllum thalictroides* contains lævulose and small quantities of citric, tartaric, and tannic acids. The crushed nuts yield to ether about 3% of oil, calculated on the whole fruits, of which a portion is volatile and the remainder belongs either to the laurin or olein group.

The pulp of the fruit of *Cornus sericea* contains potassium hydrogen tartrate, potassium hydrogen oxalate, calcium oxalate, gum, tannic, gallic, and malic acids, and a sugar, possibly lævulose. The nuts yield to ether a pale amber-coloured oil, which deposits some solid matter, perhaps palmitin, on standing. T. A. H.

Constituents of the Rhizome of Imperatoria ostruthium. Johannes Herzog (*Arch. Pharm.*, 1908, **246**, 414—417).—The author has applied the method devised for the preparation of pimpinellin (this vol., i, 905), namely, extraction with benzene and treatment of the concentrated extract with light petroleum, to this rhizome, and has isolated thereby oxypeucedanin, identical with that prepared by Erdmann and by Bothe from the root of *Peucedanum* *officinale*. Gorup-Besanez (Abstr., 1874, 907; 1877, 717) obtained ostruthin as the principal constituent of the young rhizome of *Imperatoria ostruthium*, although Heut subsequently (this Journ., 1875, 772) detected oxypeucedanin in the rhizome. It remains to be seen whether ostruthin and oxypeucedanin both occur always in the rhizome, or whether the former is replaced by the latter as the rhizome ages or is collected and stored. T. A. H.

Constituents of Saffron. BALTHASAR PFYL and W. SCHEITZ (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 337—346. Compare Hilger, Abstr., 1900, i, 682).—With the object of devising a process for the detection of inferior saffron (this vol., ii, 997), attempts were made, following lines suggested by the results of previous investigators, to obtain data regarding the properties of the chief constituents of the drug.

The methods suggested by Quadrat (*J. pr. Chem.*, 1852, **56**, 68) and Weiss (*ibid.*, 1867, **101**, 65), involving the extraction of the saffron, previously freed from fat, &c., by means of ether or light petroleum, with water, and precipitation of the colouring matter (polychroit or crocin) from the aqueous extract by lead acetate or alcohol, do not yield a pure preparation, and the same is true of Kayser's process, depending on the use of animal charcoal for the extraction of the colouring matter (Abstr., 1885, 59). Only amorphous, impure preparations of crocin could be obtained, and these, on hydrolysis with acids, furnished dextrose (compare Kayser, *loc. cit.*; Schunck and Marchlewski, Abstr., 1894, i, 340).

Similarly, Kayser's crocetin (*loc. cit.*) could only be obtained as an amorphous, red mass, which, however, yielded crystalline salts with metals and certain organic bases (compare Decker, Abstr., 1906, i, 686).

Kayser's picrocrocin (*loc. cit.*) could not be prepared, although by using his process for its isolation a small amount of a white, crystalline *substance*, m. p. 67°, which did not reduce Fehling's solution, was obtained.

From a chloroformic extract of saffron, three substances were isolated: (1) a colourless, crystalline *product*, m. p. 280°, which did not reduce Fehling's solution; (2) a yellow, crystalline *substance*, m. p. 164°, readily soluble in water or alcohol, which when boiled with acid developed the odour of saffron oil and yielded a reducing sugar, probably lævulose, and (3) a crystalline hydrocarbon, m. p. 118° (compare Schüler, *Inaug. Diss. Munich*, 1899, and Hilger, *loc. cit.*), apparently similar to the hydrocarbons found in marigold petals, arnica flowers, &c. The second of these products somewhat resembles the picrocrocin described by Kayser.

An alcoholic extract of saffron contains, in addition to colouring matter, a sugar (? lævulose) and a glucoside, which, on hydrolysis yields saffron oil and lævulose (?). The sugar provisionally regarded as lævulose is lævorotatory, reduces Fehling's solution, yields phenylglucosazone, and gives the Seliwanoff reaction (Abstr., 1903, ii, 616). T. A. H.

Have Manganese Salts, Employed as Stimulants, a Favourable Influence on Vegetation? SIGURD RHODIN (*Bied. Zentr.*, 1908, **37**, 667—668; from *K. Landtbr. Akad. Handl. Tidskr. Stockholm*, 1908, 30—33).—Field experiments with oats grown on peaty soil and with potatoes on rich garden soil. Manganese peroxide (1 kilo. per are), manganese acetate, and benzoate (30 grams per 100 square metres) reduced the yield of oats. In the potato experiment, manganese sulphate (6 kilos. per hectare) was employed. One variety of potatoes showed an increase of 1% of starch on the manganese plot; the total starch was, however, considerably less than without manganese, owing to the smaller yield of tubers. N. H. J. M.

Manurial Experiments with Nitrogen in 1907. HENRIK G. SÖDERBAUM (*Bied. Zentr.*, 1908, **37**, 657—659; from *K. Landtbr. Akad. Handl. Tidskr. Stockholm*, 1908, 104—110).—Oats were grown in sandy soil (25 kilos. per pot), and manured with 0·25, 0·5, and 0·75 gram of nitrogen in different forms, in addition to minerals. The relative manurial effects of the nitrogen compounds varied according to the amounts employed. With the smallest amounts, sodium nitrate gave the highest yields. When 0·5 gram of nitrogen was applied, ammonium sulphate gave the best results; then Polzeniusz's, Carlson's, and Frank's calcium cyanamide preparations; the next best were sodium nitrate and albumin (about equal), and last, calcium nitrate. With the largest amounts of nitrogen, ammonium sulphate was again the best; then Carlson's and Polzeniusz's calcium cyanamide; Frank's cyanamide gave considerably less produce, whilst calcium nitrate was again the least satisfactory.

The total divergence of the results from those of the previous year is attributed to the unusually low temperature in 1907, and the consequent more prolonged vegetative period. N. H. J. M.

Field Experiments with Ammonium Sulphate. HERMANN BACHMANN (*Bied. Zentr.*, 1908, **37**, 664—665; from *Fühling's Landw. Zeit.*, 1907, 530).—Experiments with rye, oats, barley, and mangolds grown on sandy soil and on loam showed that ammonium sulphate produced considerably greater yields than sodium nitrate.

N. H. J. M.

Utilisation of Nitrogen in the Form of Ammonium Nitrate. THEODOR PFEIFFER, A. HEPNER, and L. FRANK (*Bied. Zentr.*, 1908, **37**, 663—664; from *Mitt. Landw. Inst. K. Univ. Breslau*, 1908, **5**, 341).—The plants were grown in sand, and manured with ammonium nitrate and sulphate and sodium nitrate respectively. The position of ammonium nitrate as a manure is between sodium nitrate and ammonium sulphate; it may, however, under certain conditions, equal sodium nitrate. Addition of sodium chloride had no appreciable effect: The favourable results obtained by Wagner with sodium chloride in conjunction with ammonium sulphate may have been due to the presence of zeolites in the soil.

Addition of phosphorite along with ammonium nitrate increased the yield and also the amount of nitrogen taken up. N. H. J. M.

Manurial Trials with Sodium Nitrate and Ammonium Sulphate. H. CLAUSEN (*Bied. Zentr.*, 1908, **37**, 585; from *Illustr. landw. Zeit.*, 1907, **27**, 842).—Ammonium sulphate proved more effective than sodium nitrate on potatoes, rye, and oats growing on sandy soils. The superiority may be accounted for in several ways; there are indications that the potato plant can directly assimilate ammonia, so that nitrification becomes unnecessary; it is also known that sodium nitrate washes into the sub-soil, and is therefore lost more readily than ammonium sulphate. On the soils in question, Wagner's generalisation, that ammonium sulphate is only 75% as effective as sodium nitrate, clearly does not hold, and the author is of opinion that results similar to his own would commonly be obtained elsewhere.

E. J. R.

Plot Experiments on the New Nitrogenous Manures. HJALMAR VON FEILITZEN (*Bied. Zentr.*, 1908, **37**, 659—663; from *Svenska Mosskulturförening. Tidskr.*, 1908, 91—108).—Calcium nitrate produced higher yields of potatoes and of starch than potassium nitrate both on incompletely humified *Sphagnum* soil deficient in nitrogen, and on peat soil rich in nitrogen. Similar experiments with oats grown in sandy peat gave similar results.

Experiments in which different varieties of potatoes were grown in sandy soil, and manured respectively with sodium nitrate and two calcium cyanamide preparations, showed that, whilst the plants manured with cyanamide developed somewhat better than those on the nitrate plots, the final yields both of potatoes and starch were highest where nitrate had been supplied. N. H. J. M.

Analytical Chemistry.

A Shortened Burette. F. TSCHAPLOWITZ (*Zeitsch. anal. Chem.*, 1908, **47**, 697—698).—The apparatus consists of two 25 c.c. burettes connected at their lower end with a single tap. When the contents of one of the burettes has been run off through the tap, a half-turn of the latter enables the contents of the second burette to be used.

W. P. S.

Combined Wash-bottle and Pipette. J. W. HOGARTH (*J. Roy. Soc., New South Wales*, 1905, **38**, 418—420).—A modified wash-bottle by means of which it is possible to deliver an exactly measured volume of liquid. P. H.

Destruction of Organic Substances. M. KERBOSCH (*Pharm. Weekblad*, 1908, **45**, 1210—1213).—The author emphasises the importance of the absence of organic matter in testing for metallic poisons, and describes a method for destroying it by heating the material with a mixture of sulphuric acid and nitric acid. The method has been applied to milk, peas, meat, and sardines.

A. J. W.

The Use of Nitrous Acid, Nitrites, and Aqua Regia in the Estimation of the Mineral Constituents of Urine. Joseph H. Kastle (*Amer. J. Physiol.*, 1908, **22**, 411—422).—The difficulty of incinerating urine completely is well known. If, however, the urea is first got rid of by heating with sodium nitrite, nitrous acid, or aqua regia, incineration is rapidly accomplished, and the inorganic constituents of the ash can be estimated accurately. Each of the three reagents mentioned has special advantages in certain cases.

W. D. H.

Action of Thiosulphate on Permanganate in Alkaline Solution. Heinrich Kiliani (*Chem. Zeit.*, 1908, **32**, 1018).—Reinige proposed to estimate alkali iodides by titration with permanganate (conversion into iodate), and to estimate the excess by means of thiosulphate, when tetrathionate was supposed to be formed. The author, having received a private communication from Herms, has had the matter investigated, and now states that in the oxidation of thiosulphate in alkaline solution, sulphate is formed. Hence, when using Reinige's process, it must be remembered that 8 mols. of potassium permanganate do not require 24, but only 3, mols. of sodium thiosulphate for decolorisation. L. de K.

Estimation of [Organic] Sulphur by Carius' Method. Erwin Rupp (*Chem. Zeit.*, 1908, **32**, 984).—It is recommended to add barium chloride when oxidising the substance with nitric acid instead of adding it when the oxidation is finished. The barium sulphate thus obtained is of a coarse structure, and consequently readily washed and collected. It must be remembered that it always contains barium nitrate, from which it may be freed by boiling with 150—200 c.c. of water, any large particles being broken up with a glass rod. L. de K.

Volumetric Estimation of Sulphuric Acid. Thomas Cooksey (*J. Roy. Soc., New South Wales*, 1907, **41**, 215—217).—The author has improved the titration of barium and calcium salts by means of $N/10$ sodium carbonate and phenolphthalein as indicator, by adding alcohol in such quantity that, after the experiment is finished, the liquid will contain about half its bulk of it. Before titrating, the liquid must, if necessary, be rendered neutral to phenolphthalein with potassium hydroxide. The barium or calcium carbonate is immediately precipitated, and the end reaction becomes very distinct.

Sulphates (if necessary, freed from metals other than alkalis) are estimated conveniently by adding to the carefully-neutralised solution a definite amount of barium chloride, the excess of which is then estimated by the above process. L. de K.

Modification of Hüfner's Method for the Volumetric Estimation of Nitrogen. VICTOR VON CORDIER (*Zeitsch. anal. Chem.*, 1908, **47**, 682—687).—The apparatus used consists of a cylindrical bulb with a long neck, which is provided with a side-tube, the whole being similar to a Victor Meyer's vapour density apparatus. The bulb has a capacity of about 100 c.c., and is fitted with a stoppered tubulure for introducing the sodium hypobromite solution. A second bulb is also provided, and serves as a reservoir for a further quantity of the solution; it is attached to the main bulb by a tapped tube, which enters the shoulder of the main bulb, and also at its top by a second tapped tube, which is connected with the neck of the apparatus. About 50 c.c. of Knop's (sodium hypobromite) solution are placed in the main bulb, and about 40 c.c. in the reserve bulb. When required, this portion of the solution is allowed to enter the main bulb by opening both the taps. The use of the apparatus enables a larger quantity of substance to be taken for the estimation, and results of experiments are given showing that the method may be used for the estimation of nitrogen in guanidine picrate, urea nitrate, acetylurea, ammonium platinichloride, &c. W. P. S.

Estimation of Ammonia in Urine. A. RONCHÈSE (*Bull. Soc. chim.*, 1908, [iv], 3, 840. Compare Abstr., 1907, ii, 651).—A claim for priority against Malfatti (this vol., ii, 531). E. H.

Presence of Nitrite and Ammonia in Well-water and Its Signification. J. VAN EYK (*Pharm. Weekblad*, 1908, **45**, 1162—1165).—At the ordinary temperature, zinc reduces nitrates in aqueous solution to nitrites, and then to ammonia. The author considers that nitrates in well-water may be reduced to nitrites by the zinc employed to galvanise the iron pipes of water pumps. A. J. W.

Estimation of Phosphorus, Sulphur, and Silicon in Acetylene. ADOLF FRAENCKEL (*Chem. Zentr.*, 1908, ii, 643—644; from *J. Gasbeleuchtung*, 1908, **51**, 431—435).—The acetylene generated from a known weight of calcium carbide is burnt in a special apparatus, and the products of combustion are drawn through sodium hypobromite solution.

On evaporating to dryness with addition of hydrochloric acid, the silica is obtained; in the filtrate from this, the phosphoric acid is estimated as usual with magnesia mixture. Sulphur is estimated similarly by passing the products of combustion through sodium hypobromite and estimating the sulphuric acid formed as usual.

L. DE K.

Estimation of Phosphoric Acid by Lorenz's Method. OTTOKAR FALLADA (*Chem. Zentr.*, 1908, ii, 827—828; from *Osterr.-ung. Zeitsch. Zucker.-Ind. Landw.*, 1908, **37**, 333—336).—Lorenz's method (direct weighing of the yellow precipitate) is recommended, and will be found useful for the estimation of citrate-soluble phosphoric acid.

L. DE K.

Estimation of Arsenic in Iron Ores. Marcel Guedras (*Chem. Zentr.*, 1908, ii, 444; from *Rev. gener. Chim. pure appl.*, 1908, **11**, 251—253).—One gram of the finely-powdered ore is boiled in a 500 c.c. flask with 150 c.c. of hydrochloric acid and 5 grams of stannous chloride, and the distillate is collected in a graduated 100 c.c. receiver containing 50 c.c. of water.

When 40 c.c. have passed over, the distillate is nearly neutralised, a few grams of sodium hydrogen carbonate are added, and the arsenic is titrated as usual with standard iodine. L. de K.

Apparatus for the Estimation of Carbon in Iron. Max Widemann (*Chem. Zentr.*, 1908, ii, 724—725; from *Zeitsch. Chem. Apparatenkunde*, 1908, **3**, 296).—An improved flask and condensation arrangement. The essential improvement consists in the condensing tube being fitted with 5 bulbs. The gaseous products escape through a side-tube. The tube carrying off the water is fitted with a funnel, in which the water rises in case of sudden pressure, thus preventing the tube from cracking. L. de K.

Simultaneous Estimation of Carbon, Hydrogen, and Nitrogen, &c., in Organic Compounds by the Method of Simplified Elementary Analysis. Max Dennstedt and F. Hassler (*Ber.*, 1908, **41**, 2778—2782).—Oxygen, prepared by heating potassium permanganate, passes through a sulphuric acid tube, through one limb of a T-piece, and through a soda-lime-calcium chloride tube into the bifurcated entry-tube of the combustion apparatus. Through the other limb of the T-piece, oxygen is driven into a weighted rubber bag (15 kilo. per 300 sq. cm.) which acts as a reservoir, by which the current of oxygen during the combustion can be adjusted to a nicety. The combustion tube and absorption apparatus are arranged as usual. To absorb oxygen, a 1 litre Erlenmeyer flask is provided with a two-holed stopper, through which one tube, passing to the bottom of the flask, is connected with an ordinary pressure-adjusting bulb, whilst a capillary T-piece, passing just through the other hole, is connected by one limb with the combustion apparatus, a safety bottle being inserted to prevent back-suction; the other limb of the T-piece, provided with rubber tubing and a pinch-cock, serves as a gas-exit.

The best absorbent of oxygen is cuprous chloride in hydrochloric acid containing pieces of copper gauze. The solution is prepared best from copper sulphate and an excess of hydrochloric acid, as the presence of sulphuric acid increases the rate of absorption of the oxygen. The solution is efficient so long as copper gauze remains undissolved.

The expulsion of air from the whole apparatus requires one to one and a-half hours. At the completion of the combustion the nitrogen is swept into the Erlenmeyer flask for about twenty minutes; after standing overnight, the nitrogen is measured in a Hempel burette. Any nitrogen retained as lead nitrate by the lead peroxide must be extracted by 33% alcohol, the solution evaporated, and the residue of lead nitrate weighed. Sulphur and the halogens are estimated as described in previous communications.

The method is most suitable for the analysis of costly substances, difficult to obtain pure. C. S.

Volumetric Estimation of Sodium Hydroxide in the Presence of Sodium Carbonate. A. C. ANDERSEN (*J. Pharm. Chim.*, 1908, **28**, 370—371; from *Tidskr. Kem. Farm. Terapi*, 1908, **11**, 161).—This estimation is generally carried out by adding barium chloride, which precipitates the carbonate and leaves the hydroxide; the latter is then titrated with standard acid and phenolphthalein as indicator. But in order to obtain trustworthy results, the author proposes the following slight modification.

After operating in the manner described, another portion of the solution is taken, and sufficient standard acid is added to neutralise the greater part of the hydroxide. The liquid is then heated to boiling, and a slight excess of barium chloride solution is added. When the liquid has cooled (the flask being closed), the titration is continued with phenolphthalein as indicator. L. DE K.

Ready Means of Comparing Sodium Carbonate and Oxalic Acid Solutions. A. TIAN (*Chem. Zentr.*, 1908, ii, 636; from *Rev. gen. Chim. pure appl.*, 1908, **11**, 208).—The process is based on the fact that oxalic acid liberates the mineral acid from a calcium salt. A measured amount of the oxalic acid solution to be tested is mixed with an excess of calcium chloride, and the turbid liquid titrated with sodium carbonate solution, using helianthin as indicator.

L. DE K.

Estimation of Small Amounts of Barium in Rocks. RALPH W. LANGLEY (*Amer. J. Sci.*, 1908, [iv], **26**, 123—124).—The author estimates small amounts of barium in rocks by precipitation with sulphuric acid immediately after the separation of silica. It is necessary to re-dissolve the barium sulphate in concentrated sulphuric acid, and to precipitate it with water, in order to free it from ferric and other sulphates. If barium is not removed as sulphate, it is precipitated as phosphate, and introduces an error in the estimation of magnesium. R. J. C.

Separation of the Metals which are Precipitated by Hydrogen Sulphide. H. BOLLENBACH (*Zeitsch. anal. Chem.*, 1908, **47**, 690—693).—The metals which are precipitated by hydrogen sulphide, and are insoluble in ammonium sulphide, namely, mercury, lead, bismuth, cadmium, and copper, may be separated from each other by the following method. The precipitated sulphides are treated with nitric acid, when all but the mercury goes into solution. Ammonium persulphate is added to the solution, then a considerable excess of ammonia, and the mixture is boiled. Lead and bismuth are precipitated and removed by filtration. The precipitate is dissolved in concentrated hydrochloric acid; one portion of the solution is rendered ammoniacal, then acidified with acetic acid, and tested with potassium dichromate, a yellow precipitate denoting the presence of lead (bismuth chromate is readily soluble in acetic acid).

A second portion of the hydrochloric acid solution is treated with stannous chloride, and sufficient sodium hydroxide is added to redissolve the stannous hydroxide. A black precipitate shows that bismuth is present. The filtrate from the lead and bismuth peroxides is boiled with hydrochloric acid to decompose the ammonium persulphate, and then rendered ammoniacal. A blue coloration denotes the presence of copper. The blue solution is then treated with potassium cyanide and hydrogen sulphide, when a yellow precipitate is obtained if cadmium is present. W. P. S.

Electrolytic Estimation of Thallium and Probable Existence of a New Oxide of this Metal. GINO GALLO and G. CENNI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 276—284).—When a solution of thallous sulphate, slightly acidified with sulphuric acid, is electrolysed, the whole of the thallium is deposited on the anode in the form of an oxide, generally supposed to be the sesquioxide. It was found, however, by Heiberg (Abstr., 1903, ii, 614) that, when the deposit of oxide is heated in order to dry it, its weight at first diminishes and subsequently increases, this increase being supposed by him to be due mainly to the action on the oxide of sulphur dioxide from the gas heating the oven, whilst Werther (*J. pr. Chem.*, 1864, **91**, 385) regarded it as being caused by the absorption of carbon dioxide. The authors find that the minimum weight of the deposit is greater than that of the sesquioxide corresponding with the amount of thallium employed, their results indicating that the sesquioxide is converted into an oxide of the composition Tl_3O_5. The oxide Tl_2O_3 is probably transformed partly into TlO_2, which, with Tl_2O_3, gives the compound Tl_3O_5. The formation of such an oxide is not surprising, considering the position of thallium between mercury and lead in the periodic system, and also the existence of mercury peroxide (compare Antropoff, *Zeitsch. Elektrochem.*, 1906, **12**, 585; Pellini, *Gazzetta*, 1908, **38**, i, 71).

The best precedure for the quantitative, anodic deposition of thallium as oxide is to dissolve thallous sulphate in about 100 c.c. of water in a Classen capsule, the solution being acidified by the addition of about 0·1 gram of oxalic acid, and electrolysed at the ordinary temperature with a platinum disk rotating at 800 revs. per minute as negative electrode; the voltage should be 3—4, and the current density, 0·15—0·20 ampere. The end of the electrolysis is ascertained by adding a little water so as to raise the level of the liquid in the capsule; no deposit should appear on the clean platinum surface thus freshly brought into contact with the solution. The weight of the deposit, after drying at 160—200°, corresponds with the formula Tl_3O_5, and, when dissolved in hydrochloric acid, the oxide causes evolution of chlorine and forms the chloride, $TlCl_3,3TlCl$. The oxide hence decomposes according to the equation:

$$8Tl_3O_5 = 3Tl_2O_3 + 9Tl_2O + 11O_2,$$

and the authors regard it as having the structure

$$O{:}Tl{\cdot}O{\cdot}Tl({:}O){\cdot}O{\cdot}Tl{:}O.$$

T. H. P.

Analysis of a Mineral containing Copper, Bismuth, Lead, Silver, Calcium, Iron, and Quartz. August Chwala and V. Macri (*Chem. Zentr.* 1908, ii, 261; from *Mon. Sci.*, 1908, [iv], **22**, 372).—The mineral is decomposed by means of nitric acid and potassium chlorate, and a solution of ammonium nitrate is added to keep lead and calcium sulphates in solution. The siliceous matter is then collected and washed, first with a hot acid and then with a hot ammoniacal solution of ammonium nitrate. After removing any silver from the filtrate by means of hydrochloric acid, sulphuric acid is added, and then excess of ammonia, which precipitates the iron only; this is washed first with an acid and then with an ammoniacal solution of ammonium nitrate. The bismuth is then precipitated with ammonium carbonate, and, finally, the copper and lead are separated as usual. L. de K.

Solubility of Rare Earth Oxalates in Solutions containing Uranyl Salts. Otto Hauser (*Zeitsch. anal. Chem.*, 1908, **47**, 677—680).—It is pointed out that uranyl salts have a considerable solvent action on cerium and lanthanum oxalates, and, unless a considerable excess of oxalic acid is added, the results obtained in the usual method of precipitating these earths as oxalates are untrustworthy, if uranyl salts are present. W. P. S.

Separation of the Metals of the Ammonium Sulphide Group. Erich Ebler (*Zeitsch. anal. Chem.*, 1908, **47**, 665—677).—The following process of separating the metals precipitated by ammonium sulphide is recommended. The precipitate, consisting of iron, manganese, nickel, cobalt, and zinc sulphides, and aluminium and chromium hydroxides, is boiled with hydrochloric acid until all the hydrogen sulphide has been expelled, then oxidised with nitric acid, and treated with hydrogen peroxide and sodium hydroxide. The precipitate, which contains the iron, manganese, nickel, and cobalt, is separated by filtration, dissolved in hydrochloric acid, hydrogen peroxide is added, and the iron and manganese are precipitated with ammonia; these two metals are separated from their hydrochloric acid solution by the addition of ammonium chloride, hydroxylamine hydrochloride, and ammonia, the iron being precipitated, whilst the manganese remains in solution. The nickel and cobalt are separated by adding dicyanodiamide and potassium hydroxide to the filtrate containing them; the nickel is precipitated as a crystalline compound. The filtrate containing the aluminium, chromium, and zinc is boiled, and ammonium chloride is added repeatedly until ammonia ceases to be given off; the aluminium hydroxide thus precipitated is removed by filtration, and the filtrate is treated with sulphurous acid after acidifying with hydrochloric acid. The addition of ammonia to the hot solution precipitates the chromium, leaving the zinc in solution.
W. P. S.

Estimation of Iron, Alumina, and Phosphoric Acid in Presence of Each Other. Thomas Cooksey (*J. Roy. Soc., New South Wales*, 1907, **41**, 163—171).—The acid solution is mixed with a definite amount of a standard solution of sodium dihydrogen phosphate, and potassium hydroxide solution is added until the liquid is neutral to methyl-orange. The whole is diluted to 80—90 c.c., and heated on the water-bath until the precipitate has settled. To the filtrate is added an excess of calcium chloride, the liquid is acidified slightly with *N*/10 acid, boiled to expel carbon dioxide. and the free phosphoric acid is titrated with *N*/10 potassium hydroxide, using phenolphthalein as indicator, as soon as the liquid is neutral to methyl-orange; 1 c.c. = 0·00355 gram of P_2O_5.

The iron oxide is determined iodometrically, and calculated to ferric phosphate. This deducted from the weight of the first precipitate gives the aluminium phosphate, which is then calculated to alumina. From the total phosphoric acid found, is then deducted the amount purposely added. L. DE K.

Separation of Iron from Nickel and Cobalt by Lead Oxide. T. H. LABY (*J. Roy. Soc., New South Wales*, 1904, **37**, 157).—After trying the separation by means of ammonium hydroxide and chloride, ammonium carbonate, the basic acetate process, the phosphate method, the electrolytical separation, and the ether extraction process, the author finally calls attention to a process given by Field (*Chem. News*, 1859, 1, 5), which he finds is also suitable for the separation of iron from cobalt.

In this process the iron is precipitated as hydroxide by evaporating the nitrate solution with excess of lead oxide; the lead is separated readily from the filtrate with sulphuric acid. The nickel or cobalt is then estimated electrolytically in ammoniacal solution. L. DE K.

Detection of Cobalt in the Presence of Large Quantities of Nickel. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1908, **13**, 390—391).—Supposing the amount of nickel to be about 1000 times that of the cobalt, the solution containing about 10 grams of the nitrates is concentrated to 25—50 c.c. and mixed while hot with 50 grams of ammonium molybdate dissolved in a little boiling water. When cold, the liquid is filtered from the nickel precipitate, and the rose colour of the cobalt becomes visible. On boiling with excess of sodium hydroxide and a little hydrogen peroxide, the cobalt is obtained as a brown oxide, which may then be identified by means of the borax bead. L. DE K.

Approximate Colorimetric Estimation of Cobalt and Nickel in the Presence of Each Other. R. W. CHALLINOR (*J. Roy. Soc., New South Wales*, 1905, **38**, 406—417).—The two metals are estimated jointly by electrolysis, and then dissolved in dilute nitric acid (1 : 1). After evaporating nearly to dryness, the mass is dissolved in water and diluted to a known volume. If the liquid is green, more than 76% of nickel is present; an aliquot portion of the liquid, containing 0·04—0·05 gram of the mixed metals, is taken, and a standard solution of cobalt is run in until the colour (after diluting to the 50 c.c. mark) is equal to that of a standard solution containing the nearest weight of the mixed metals. If, however, the solution is pink, showing the presence of more than 24% of cobalt, standard nickel is run in, any excess of which may be again checked with cobalt.

After allowing for nickel added, the amount of nickel in the mixture is readily calculated. L. DE K.

Iodometric Estimation of Chromic and Vanadic Acids in the Presence of Each Other. GRAHAM EDGAR (*Amer. J. Sci.*, 1908, [iv], **26**, 333—336).—The mixed acids (about 0·2 gram) are boiled with 15 c.c. of hydrochloric acid and 2 grams of potassium bromide in a Voit flask, a slow current of hydrogen is passed, and the bromine evolved, owing to the reduction of $2CrO_4$ to Cr_2O_3 and V_2O_5 to V_2O_4, is absorbed in an alkaline solution of potassium iodide contained in a Drexel bottle connected with a Will and Varrentrap trap, also containing the same solution. After the operation is over, the potassium iodide solution is acidified with hydrochloric acid, and the iodine set free titrated as usual. The Drexel bottle is then filled with fresh potassium iodide solution.

To the contents of the Voit flask are now added 2 grams of potassium iodide, 15 c.c. of hydrochloric acid, and 3 c.c. of syrupy phosphoric acid, and the distillation is repeated as before in a current of hydrogen. The hydriodic acid acts on the V_2O_4, reducing this to V_2O_3 with liberation of iodine, which is absorbed in the Drexel bottle and titrated as usual. The second titration therefore gives the vanadic acid only, and the difference between the first and second gives the necessary data for the calculation of the chromic acid.

L. DE K.

Tin. DAVID B. DOTT (*Pharm. J.*, 1908, [iv], **27**, 486).—Contrary to general belief, metastannic acid, formed by the action of nitric acid on tin, is soluble in hydrochloric acid. All quantitative processes based on the separation of silica from tin by evaporation to dryness are untrustworthy, as a large proportion of the tin volatilises as chloride. The author proposes the following method for the estimation of tin in the presence of antimony.

The solution is divided into two equal portions. In one of these, both metals are precipitated with hydrogen sulphide, and the precipitate is then converted in the usual manner into a mixture of tin and antimony dioxides. The other portion is saturated with oxalic acid, heated, and treated with hydrogen sulphide, which now precipitates the antimony only; this is then converted into dioxide and deducted from the joint weight.

Low's modification of Pearce's method for the estimation of tin in ores, by fusing with sodium hydroxide, dissolving in hydrochloric acid, reducing by boiling with iron wire, and, after filtering into a flask filled with carbon dioxide, rapidly titrating with standard iodine, gives good results. L. DE K.

Analysis of Oxidised Antimony and Lead Sulphide Compounds. FELIX JACOBSOHN (*Chem. Zeit.*, 1908, **32**, 984—985).—The article is mainly devoted to the assay of commercial Sulphur antimonii auratum (this vol., ii, 540).

The process is also applicable to lead sulphide. For the estimation of free sulphur, the use of boiling chloroform is recommended.

L. DE K.

Volumetric Estimation of Bismuth. PIERRE BALAVOINE (*Zeitsch. anal. Chem.*, 1908, **47**, 681).—The author mentions that previous to the publication of the results of Moser's investigation (Abstr., 1907, ii, 433) on the volumetric estimation of bismuth, he had recorded the results of experiments showing that the method was untrustworthy.

W. P. S.

Analysis of Organic Mixtures with the Aid of the Refractometer. ERNST E. SUNDWICK (*Pharm. Zentr.-h.*, 1908, **49**, 783—787).—Some remarks on the process of Beythien and Hennicke (this vol., ii, 72).

The author's own process is based on the following equations: (1) $V : V_1 = C_1 - B : C - B$, in which V and V_1 represent two volumes containing the same amount of dissolved matter, C the refraction of the joint solution, and B the refraction of the solvent (water, alcohol, chloroform, acetone, toluene, &c.); (2) $V(C - B) =$ constant, and (3) $P(C - B)/d =$ constant.

L. DE K.

Methyl Alcohol and its Impurities. FRANZ FRIEDRICHS (*Chem. Zeit.*, 1908, **32**, 890—891).—In examining methyl alcohol for impurities, the carbylamine test for chloroform should not be omitted, in view of the fact that methyl alcohol is sometimes treated with bleaching powder in order to remove acetone, which is thereby converted into chloroform.

P. H.

Gravimetric Alcoholometry. BLONDEAU (*Bull. Assoc. Chim. Sucr. Dist.*, 1908, **26**, 148—160).—Tables are given showing the weight of alcohol per hectolitre of mixtures of alcohol and water. The values are given for each reading of the Gay-Lussac alcoholometer between 1 and 100 at temperatures from 0° to 30° (compare Abstr., 1908, ii, 738).

W. P. S.

New Differential Reactions of the Naphthols. VOLCY-BOUCHER (*Ann. Chim. anal.*, 1908, **13**, 335—338).—The following reagents are used: Alcohol of 95° (French), a 10% solution of copper sulphate, and a 10% solution of potassium cyanide prepared just before use.

Identification of the Naphthols.—0·5 Gram of the substance is placed in a test-tube, and dissolved in the smallest possible quantity of alcohol, added drop by drop. Two c.c. of the copper solution are added, and, after thorough shaking, 4 c.c. of the cyanide. With α-naphthol an abundant, violet-red precipitate is obtained; β-naphthol yields a yellow precipitate. If now just sufficient alcohol is added to dissolve the precipitate, a rose-coloured liquid showing a violet reflection will be obtained with the α-compound, but a golden-yellow solution in the case of β-naphthol.

Identification of the Camphorated Naphthols.—A thread of the substance is placed in a test-tube, and 2 c.c. of copper solution are added. The substance, which floats on the surface, is dissolved by cautious addition of alcohol, and 4 c.c. of the cyanide are then added. The result is the same as with the ordinary naphthols.

The same process serves for the detection of small proportions of α-naphthol in the β-compound. Benzonaphthol does not give the reaction. L. DE K.

Estimation of Lactose by Ammoniacal Copper Salt Solutions. YOSHITAKA SHIMIDZU (*Biochem. Zeitsch.*, 1908, **13**, 243—261).—Lactose can be estimated by means of the Kumagawa-Suto modification of Pavy's method, if it is first hydrolysed into dextrose and galactose. For the latter purpose, 10% sulphuric acid, or 5% hydrochloric acid, are suitable, and inversion is complete within one hour if 100 c.c. of acid is used for 0·25 to 1 gram of the sugar. The method is applicable to the estimation of sugar in milk. S. B. S.

Precipitation of Lævulose by Basic Lead Acetate. H. C. PRINSEN-GEERLIGS (*Zeitsch. Ver. deut. Zuckerind.*, 1908, 932—936). —The results of the experiments recorded show that, whilst basic lead acetate does not precipitate lævulose from its solution when the latter contains nothing but the sugar, an appreciable quantity of the sugar is precipitated if other substances which yield insoluble lead compounds are also present. As all syrups and crude sugars give such solutions, these, when clarified with basic lead acetate, furnish filtrates containing less lævulose than the original solution. The reducing sugar precipitated is shown to be actually lævulose. W. P. S.

Detection of Formic Acid in Honey. TH. MERL (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 385—389).—Formic acid is best detected in honey by heating the sodium formate, obtained on evaporating the neutralised distillate of the honey, with concentrated sulphuric acid. The carbon monoxide produced is collected over potassium hydroxide solution, and, if its volume is measured, the quantity of formic acid present may be calculated. Lactic acid, which may also be present in the distillate, yields carbon monoxide on treatment with sulphuric acid, and a portion of the distillate should therefore be oxidised with permanganate and the resulting oxalic acid estimated. The quantity of carbon monoxide due to the lactic acid is then deducted from the total volume of gas found. The calomel formed by the action of formic acid on mercuric chloride may also be employed as a measure of the amount of formic acid present, but it is pointed out that other substances present in honey distillates reduce mercuric chloride.

W. P. S.

Acidification and Distillation of Fatty Acids; Distilled Oleic Acid. HUGO DUBOVITZ (*Chem. Zentr.*, 1908, ii, 545; from *Seifensieder Zeit.*, 1908, **35**, 728—729).—The acidification of the fatty acids yields, according to Benedikt, sulphostearic acid, which on boiling with water yields hydroxystearic acid. The author, however, obtained about twice the quantity of hydroxystearic acid than would be expected, and has therefore altered Benedikt's formula for sulphostearic acid into

$$SO_4(C_{17}H_{34}\cdot CO_2H)_2.$$

The presence of small quantities of neutral fat in commercial oleic acid ("distillation olein") is difficult to confirm, owing to the possible presence of anhydrides and lactones. Owing to the presence of volatile fatty acids, the estimation of water in the oleic acid should be effected in a vacuum over calcium chloride. L. DE K.

Estimation of β-Hydroxybutyric Acid in Urine. PHILIP A. SHAFFER (*J. Biol. Chem.*, 1908, **5**, 211—224).—Previous methods for the estimation of this acid are criticised. The method proposed is to distil with sulphuric acid and potassium dichromate, when under suitable conditions, the acid is converted quantitatively into acetone, which is then determined by standard iodine and thiosulphate solutions. A number of precautions, especially in estimations in urine, have to be taken. W. D. H.

Detection and Estimation of β-Hydroxybutyric Acid in Urine. OTIS F. BLACK (*J. Biol. Chem.*, 1908, **5**, 207—210).—Acetoacetic acid is recognised by the red colour produced by ferric chloride. If β-hydroxybutyric acid is tested in the same way in the presence of hydrogen peroxide, the same colour reaction is obtained. In applying the test to urine, evaporation at a gentle heat gets rid of acetoacetic acid; the residue is acidified with hydrochloric acid, and made into a paste with plaster of Paris. This is broken up and extracted with ether, the ether is evaporated, and the test applied to the residue. For quantitative purposes, the residue is extracted with water and examined with a polarimeter. W. D. H.

Natural and Added Free Tartaric Acid in Natural Wines. H. ASTRUC and J. MAHOUX (*Bull. Soc. chim.*, 1908, [iv], **3**, 840—845; *Ann. Chim. anal.*, 1908, **13**, 307—315).—The method of estimating the total tartaric acid and the total potassium in a wine, and deducing therefrom the amount of free tartaric acid, gives too low a value for the latter, since the amount of potassium combined with other acids is neglected. In this manner, excessive (added) quantities of free tartaric acid in natural wines are overlooked.

The authors have estimated the total tartaric acid and potassium by the official methods, and the added tartaric acid and total potassium by other methods, in three natural wines prepared by the authors, both when untreated and after addition of variable known quantities of tartaric acid and potassium, and draw the following conclusions from their results. The official methods are liable to large errors in opposite directions, the other methods (Pasteur, Reboul, Magnier de la Source, &c.) are more trustworthy, and should therefore be preferred; it is also more accurate to ignore the estimation of total potassium, and to evaporate in the presence of potassium bromide, in order to estimate free tartaric acid. It is impossible to distinguish natural from added tartaric acid in potable wines.

The authors' results contradict the statement that natural wines from ripe grapes are necessarily always free from tartaric acid.

E. H.

Method of Estimating Succinic Acid in Fermented Liquids containing Other Fixed and Volatile Acids. M. Emmanuel Pozzi-Escot (*Compt. rend.*, 1908, **147**, 600—601 ; *Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 185—186 *).—The following method is stated to be trustworthy for the separation and estimation of succinic acid in solutions containing colouring matters, tannin, proteins, and fixed and volatile acids. A portion of the solution is treated with a small quantity of gelatin, neutralised with ammonia, and then rendered distinctly acid with acetic acid. Barium chloride is next added, and the precipitate, consisting of proteins, tannin, barium oxalate, barium sulphate, &c., is removed by filtration. The filtrate is boiled and treated with a considerable excess of lead acetate, which precipitates any remaining protein and tannin, and phosphoric, tartaric, and citric acids. The precipitate is collected on a filter and washed with very dilute acetic acid. The filtrate is treated with hydrogen sulphide to remove the excess of lead, and the solution is then acidified with sulphuric acid, boiled, and the malic acid is oxidised by the addition of an excess of potassium permanganate. This excess is decomposed by means of potassium hydrogen sulphite, and the sulphuric acid is removed by treatment with barium chloride. The solution is then concentrated, rendered slightly ammoniacal, and the succinic acid is precipitated by the addition of an alcoholic solution of barium bromide, a quantity of alcohol equal to three times the volume of the total solution being also added. The barium succinate is collected on a filter, washed with 60% alcohol, and ignited. The amount of succinic acid is calculated from the weight of barium carbonate obtained (compare this vol., ii, 904). W. P. S.

Naphtharesorcinol as a Reagent for Certain Aldehyde and Keto-acids. John A. Mandel and Carl Neuberg (*Biochem. Zeitsch.*, 1908, **13**, 148—151).—The reaction described by B. Tollens for glycuronic acid (heating with naphtharesorcinol and hydrochloric acid, and subsequent extraction with ether) is applicable to several other substances, especially those containing certain combinations of carboxyl and carbonyl groups in the molecule. Also, certain more complex substances, such as glucothionic acid, ovomucoid, chondroitinsulphuric acid, and various nucleo-proteins, give the reaction. S. B. S.

Separation of Benzoic Acid and Cinnamic Acid. Anne W. K. de Jong (*Pharm. Weekblad*, 1908, **45**, 1115—1116).—Scheringa's process (separation of the bulk of the cinnamic acid as calcium cinnamate and oxidation of the remainder with permanganate : Abstr., 1907, ii, 823) is, in the author's opinion, unsuitable for quantitative purposes, owing to the formation of benzoic acid. L. de K.

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* and *Ann. Chim. anal.*, 1908, **13**, 439—440.

Süchting's Method for Estimating Acidity of Soils. Br. Tacke and H. Süchting (*J. pr. Chem.*, 1908, [ii], 78, 139—142).—Mainly polemical. A reply to van Schermbeck (this vol., ii, 743).
J. J. S.

Humic Acid. A. J. van Schermbeck (*J. pr. Chem.*, 1908, [ii], 78, 285—288. Compare this vol., ii, 743).—A reply to Tacke and Süchting (preceding abstract), and a further criticism of these authors' methods.
G. Y.

Colour Reactions of Sesamé Oil with (*a*) Aromatic Aldehydes and (*b*) Various Sugars. The Similar Reactions with Biliary Acids. C. Fleig (*Bull. Soc. chim.*, 1908, [iv], 3, 984—991, 992—999).—The suggestion has been made (Mylius, Abstr., 1887, 1149) and denied (Ville, Abstr., 1907, ii, 913) that the red or violet colorations formed in the Pettenkofer test for biliary acids, and in the Camoin-Baudouin test for sesamé oil, depend on the formation of furfuraldehyde by the action of the sulphuric or hydrochloric acid on the sucrose used. The author has therefore tried to obtain definite data on this point by using (1) various aromatic aldehydes and (2) polyhydric alcohols and sugars in place of sucrose, and the results, on the whole, support Mylius' contention. It is suggested that the differences in colour produced in using furfuraldehyde instead of sucrose, as noted by Ville, may be due to secondary influences exerted by other hydrolytic products formed when sucrose is used.

Of the thirteen aldehydes tried, *p*-hydroxybenzaldehyde, anisaldehyde, protocatechualdehyde, vanillin, piperonal, and cinnamaldehyde give colours as intense as those yielded by furfuraldehyde, whilst benzaldehyde, salicylaldehyde, *o*-nitrobenzaldehyde, and *p*-dimethylaminobenzaldehyde yield less intense tints, and *m*- and *p*-nitrobenzaldehyde and cuminaldehyde are still less satisfactory.

The polyhydric alcohols and sugars tried as substitutes for sucrose in the Camoin-Baudouin reaction fall into the following five groups, in order of decreasing intensity of colour produced : (*a*) lævulose, invert sugar, sucrose, sorbose; (*b*) raffinose; (*c*) xylose, arabinose; (*d*) galactose, mannose, mannitol, dextrose; (*e*) *iso*dulcitol, erythritol, sorbitol, dulcitol, lactose, maltose, glycerol. All the sugars in this list, except arabinose, were also tried in the Pettenkofer test, and gave similar results.

In both tests the production of colour is expedited by warming the mixture slightly; hydrochloric acid may be used in place of sulphuric acid or vice versa, but in some cases the former acid is advantageous. In the tests for sesamé oil, an alcoholic extract of the oil may be used in place of the oil itself. Full details are given in the two papers as to the exact methods employed in making the tests. The second paper concludes with a summary of the literature dealing with the constituent of sesamé oil to which the production of the colour is due, and the conclusion is drawn that this coloration may be due to the presence of a number of different substances.
T. A. H.

Formation of Formaldehyde in Solutions of Sugar. A. Alexander Ramsay (*J. Roy. Soc., New South Wales*, 1907, 41, 172—175).—Attention is called to the fact, noticed amongst others by the author, that small quantities of formaldehyde are formed during the heating or distillation of saccharine liquids (jams, for instance); thus upsetting the value of some tests recommended for the detection of added formalin. L. DE K.

Identification of Thujone in Liqueurs. LOUIS DUPARC and A. MONNIER (*Ann. chim. anal.*, 1908, **13**, 378—382).—The liqueur is submitted to distillation, and 10 c.c. of the distillate (which should be of 60° alcoholic strength) is mixed with 2 c.c. of 10% zinc sulphate, 0·5 c.c. of 10% sodium nitroprusside, and then with 4 c.c. of 5% sodium hydroxide free from carbonate. After the lapse of one minute, 2 to 3 c.c. of glacial acetic acid are added, when, after a few minutes, a very characteristic, dark red precipitate forms if thujone is present.

The author has examined altogether fifty-four different essences (2 parts dissolved in 1000 parts of alcohol), and, with the exception of thujone, they yielded white or yellow precipitates; those which contained citral, however, gave an orange-red deposit. L. DE K.

Analysis of Scammony Resins. P. GUIGUES (*Bull. Soc. chim.*, 1908, [iv], **3**, 872—878).—The ether assay of scammony resin advocated by the *Codex Medicamentarius* is unsound, since (1) the resin of jalap is partly soluble in ether, whilst some resins from scammony are incompletely soluble in this solvent; (2) it permits the substitution of fusiform jalap resin, soluble in ether, for the true scammony resin; (3) it prevents the recognition of foreign resins, particularly colophony, soluble in ether; and (4) it is subject to numerous errors, and does not give constant results.

The solubility of scammony resin is not appreciably altered by boiling with water or with 10% hydrochloric acid for several hours. Assay of the resin by turpentine instead of ether is no more successful. The author proposes to detect adulteration by determination of the rotatory power. The following are the values obtained for the optical activities of resins: Commercial Tampico jalap, − 34°20′; true Orizaba jalap, − 24°45′; officinal jalap, − 36°; officinal turbith, − 30°10′ to 31°35′; ordinary colophony, + 6° to + 7°; sandarac from the Arabic bazaar, + 46°20′; pure sandarac, + 31° to + 34°; recent mastic, + 29°30′; second quality mastic, + 21°50′; guaiacum, − 17°. For scammony, the author obtained − 24°30′ as a maximum from the resin extracted from the gum-resin, and − 18°30′ to − 23°30′ for resins extracted from the roots. The rotatory power is independent of the solubility in ether. These values show that only the Orizaba jalap (fusiform) resin and guaiacum resin can be used as adulterants. Since only the scammony resins extracted from the gum resin, which are at least twice as expensive as that extracted from the root, have rotatory powers as high as − 24°30′, a resin having a_D higher than − 23°30′ is most probably fusiform jalap resin. Guaiacum resin should be readily detected by its chemical characteristics. E. H.

Detection of Arbutin in Plants. MLLE. A. FICHTENHOLZ (*J. Pharm. Chim.*, 1908, [vi], **27**, 255—262).—In applying Bourquelot's method (Abstr., 1902, ii, 55) to the detection of glucosides in plants, it is necessary to allow the emulsin to act on the plant extract during several days, as the action of the ferment is frequently slow, owing to the presence of tannic or gallic acids, which retard its activity. In the case of such glucosides as arbutin, which has a high lævorotation, it is advantageous to defecate the plant extract with lead acetate before adding emulsin. Bearberry leaves contain at least 1·66% of arbutin.

T. A. H.

Volumetric Estimation of Potassium Ferrocyanide. H. Bollenbach (*Zeitsch. anal. Chem.*, 1908, **47**, 687—690).—The following modification of de Haën's process was found to give trustworthy results. The potassium ferrocyanide solution is acidified with sulphuric acid, and an excess of $N/10$ permanganate solution is added. After the addition of a few drops of ferric sulphate solution, the excess of permanganate is titrated with $N/10$ ferrocyanide solution. Each drop of the latter added produces a greenish-blue precipitate, which disappears on shaking, as long as any permanganate remains.

W. P. S.

Detection and Estimation of Hexamethyleneamine in Pharmaceutical Mixtures. William A. Puckner and W. S. Hilpert (*J. Amer. Chem. Soc.*, 1908, **30**, 1471—1474).—The process is based on the fact that hexamethyleneamine does not suffer decomposition on boiling with aqueous potassium hydroxide, but that it is converted into formaldehyde and ammonium sulphate on boiling with dilute sulphuric acid. The ammonia formed is then readily estimated, any ammonia pre-existing in the sample under examination being removed by the preliminary alkaline treatment.

The reactions with mercuric chloride and with bromine are also useful in the identification of hexamethyleneamine. Advantage may also be taken of its solubility in chloroform.

L. de K.

Estimation of the Total Alkaloids in Cinchona Barks. N. H. Cohen (*Pharm. Weekblad*, 1908, **45**, 1089—1098).—A modification of Florence's method (Abstr., 1907, ii, 317). Five grams of the very fine powder are placed in a small corked flask, 125 grams of ether and 5 c.c. of 15% sodium hydroxide are added, and the whole is weighed. After shaking vigorously every five minutes for an hour, the flask is fitted to a vertical condenser, and the contents are boiled for half an hour. When cold, ether is added to restore the original weight, 5 c.c. of water are introduced, and, after thorough shaking, the ether is transferred to a 250 c.c. flask. Twenty c.c. of lime water are added, the flask is closed, preferably with the same cork, and the whole thoroughly shaken. One hundred c.c. of the ether are now drawn through a plug of cottonwool into a weighed 200 c.c. flask, the ether is distilled off, and the residual alkaloids dried for one and a-half hours at 100° and weighed. The weight $\times 25 =$ percentage of alkaloids, about 0·5 of which consists of impurities. These may be estimated by dissolving the alkaloids in 10 c.c. of 2% sulphuric acid and shaking the solution with ether, which is then evaporated in a weighed flask.

Florence's estimation of the quinine by means of $N/10$ ethereal oxalic acid cannot be recommended. L. DE K.

The Quantitative Relations of the Thalleoquinine Reactions. JOS. VONDRASEK (*Chem. Zentr.*, 1908, ii, 833—834; from *Pharm. Post*, 1908, **41**, 605—607).—The author recommends that the test for quinine should be carried out as follows: 0·01 gram of the quinine salt is dissolved in a mixture of 1 c.c. of N hydrochloric acid and 2 c.c. of $N/10$ potassium bromate, and boiled until the liquid turns orange-yellow. When cold, 1—2 c.c. of ammonia are added, and a dark green solution is obtained. Quinidine also gives the test. In this reaction, three atoms of chlorine are taken up by 1 mol. of quinine. The test may be also carried out in the cold, when addition of ammonia will give a dark green precipitate and a dark green liquid. On adding alcohol, a solution is obtained which is suitable for the colorimetric estimation of quinine.

Quinine and quinidine may be distinguished from cinchonine and cinchonidine by heating the aqueous solutions with excess of potassium bromate, which yields a blue liquid. The colour is destroyed on adding acid. L. DE K.

Assay of Coca. ANNE W. K. DE JONG (*Chem. Weekblad*, 1908, **5**, 645—647).—A reply to M. Greshoff (this vol., ii, 441). The author gives experimental results in support of the contention that Greshoff's method of estimating coca is untrustworthy, and attributes this to decomposition caused by heating the alkaloid salts in aqueous solution (compare Abstr., 1905, ii, 778; this vol., ii, 440).

A. J. W.

Assay of Coca. MAURITS GRESHOFF (*Chem. Weekblad*, 1908, **5**, 705—706. Compare this vol., ii, 441).—Polemical. A final reply to de Jong (preceding abstract). L. DE K.

Detection of Vegetable Poisons in Decomposed Animal Bodies. THEODOR PANZER (*Zeitsch. anal. Chem.*, 1908, **47**, 572—590).—Corpses which have undergone a considerable amount of decomposition may contain substances which yield general reactions similar to those given by the alkaloids. These substances, which are chiefly found in the brain, and to a less extent in the liver and kidneys, do not give the characteristic reactions of the separate alkaloids. If a residue is obtained from the ethereal extract of the alkaline solution obtained in the usual way (Stas-Otto method) from the organs under examination, which residue gives general alkaloidal reactions, the solution of the residue should be rendered acid with hydrochloric acid and extracted with ether; this treatment removes the substances, and the aqueous solution is then examined for alkaloids. If possible, it is preferable not to mix the brains with the other organs of the body under examination. W. P. S.

Process for the Valuation of Saffron. BALTHASAR PFYL and W. SCHEITZ (*Zeitsch. Nahr. Genussm*, 1908, **16**, 347—352).—The process depends upon the estimation of the amount of sugar formed by the hydrolysis of the glucoside soluble in chloroform, which the authors have shown occurs in saffron (this vol., ii, 979). Saffron is dried, powdered, and re-dried, and 5 grams of the preparation extracted in a Soxhlet apparatus with light petroleum and, after drying, re-extracted with dry chloroform. The solvent is evaporated from the chloroformic extract, and the residue dissolved as far as possible in acetone. The latter is evaporated, and the glucoside in the residue hydrolysed by adding 5 c.c. of *N*-hydrochloric acid and heating during fifteen minutes, water being added as required to bring the total amount of liquid up to 25 c.c. The filtrate from this is neutralised with *N*-alkali, and the sugar estimated by Allihn's method.

The best quality of commercial saffron, consisting only of the stigmas of the saffron crocus, yields in this way 0·1996 to 0·2090 gram of metallic copper, and samples yielding less than this may be regarded as having an unduly large proportion of styles included, or as containing constituents foreign to the saffron crocus. The quantity of adulterant present is not directly proportional to the diminution in the amount of copper obtained, since the latter is, in part, dependent on the concentration of sugar solution used, and a table is supplied in the original from which, by a method of interpolation, the quantity of "real saffron" present in a sample can be calculated from determinations made by the above process. Trials with the usual adulterants of saffron, namely, saffron crocus styles, logwood, red poppy petals, red peony petals, honey, marigold petals, safflower, Cape saffron, and Spanish thistle flowers, show that each of these products, when subjected to this process, yields practically no reducing substance, and that with turmeric and red sandalwood very much smaller quantities of copper are obtained than with real saffron. T. A. H.

Detection of Proteins by means of Formaldehyde. LEO VON LIEBERMANN (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 231).—Five c.c. of the solution to be tested are treated with one drop of 40% formaldehyde solution and one drop of very dilute ferric chloride solution. The mixture is then allowed to flow over the surface of 5 c.c. of concentrated sulphuric acid. If protein (albumin or albumose) is present in the solution, a violet ring is observed at the junction of the two liquids. W. P. S.

A New Reaction for Bile Acids. ADOLF JOLLES (*Zeitsch. physiol. Chem.*, 1908, **57**, 30—34; *Ber.*, 1908, **41**, 2766).—If a few drops of a 5% solution of rhamnose are warmed with a similar amount of a 0·1% solution of taurocholate or glycocholate, and a few drops of concentrated hydrochloric or sulphuric acid, a momentary red coloration is obtained, which passes in a short time into a green fluorescence. This test is given also by cholic acid, but not by glycine or taurine. The delicacy of the test is very considerable. In employing it to detect bile acids in urine, the fluid is first mixed with a solution of caseinogen, and the latter is precipitated by careful addition of sulphuric acid and filtered off. The precipitate is digested with absolute alcohol at room temperature for an hour, filtered, and the reaction tried with the filtrate. Cholesterol, albumin, urea, carbohydrates, higher hydrocarbons, and acids of the fatty and benzene series do not give the test. W. D. H.

A Colour Reaction of Bile Acids with Vanillin and Sulphuric Acid. KATSUJI INOUYE and HIIZU ITO (*Zeitsch. physiol. Chem.*, 1908, **57**, 313—314).—If vanillin is added to an aqueous solution of bile acids, and then concentrated sulphuric acid, a red ring appears at the junction of the two liquids; on shaking up the mixture, it becomes red, then brown or yellow, and finally violet. On diluting this with glacial acetic acid, a wide absorption band at *D*, reaching to *C* on one side and *E* on the other, is seen. Tables are given showing the delicacy of the test with cholic, glycocholic, and taurocholic acids. W. D. H.

The Lecithin-content of Milk. JOSEPH NERKING and E. HAENSEL (*Biochem. Zeitsch.*, 1908, **13**, 348—353).—For estimation of lecithin, 100 c.c. of milk were precipitated with 200 c.c. of alcohol. The precipitate was extracted with chloroform in a Soxhlet apparatus. The alcoholic filtrate was evaporated at 50—60°, and the residue also extracted with chloroform. The two chloroform extracts were united, and the residue, after evaporating off the solvent, incinerated with fusion mixture. The amount of phosphoric acid in the ash was estimated, and from the results, the lecithin-content calculated. The amount of lecithin from several species of animals varied (as a mean of several analyses in each case) between 0·0109 and 0·0833%.

S. B. S.

Detection of Indican in Urine. ERNST SALKOWSKI (*Zeitsch., physiol. Chem.*, 1908, **57**, 519—521).—The urine is mixed with copper sulphate solution and hydrochloric acid, and then chloroform added; the chloroform is coloured blue if indican is present. This method is described with full details, as to procedure and the precautions to be observed.

Gautier's statement that the urine of rabbits fed on cabbage does not contain indican is incorrect. W. D. H.

The Guaiacum Reaction. CARL L. ALSBERG (*Arch. exp. Path. Pharm., Suppl.*, 1908, 39—53).—Various points in relation to this test for blood are discussed, and its unsatisfactory nature pointed out. The blood of many invertebrates gives the reaction, and particular attention has been paid to blood which contains hæmocyanin. This blood gives the test even after it is boiled. Hæmocyanin itself, other copper compounds, certain manganese compounds, and other salts give the test. W. D. H.

Estimation of Catalases and Oxydases in Blood. I. WALTHER LÖB (*Biochem Zeitsch.*, 1908, **13**, 339—347).—A preliminary account is given of the apparatus employed for the estimation of the amount of oxygen evolved when a hydrogen peroxide solution is treated with blood. The gas evolved was measured both by a "volume method" and a "pressure method." In the former case, the vessel containing the peroxide was connected with a Hempel burette, and in the latter, with a manometer. The blood in both cases was contained in a small capsule resting on a plate which was fixed on to a ground stopper inserted into the side of the peroxide containing vessel above the level of the liquid. By turning the stopper through 180°, the capsule could he dropped into the peroxide solution. This was only done when the apparatus was in connexion with the burette or manometer, and had reached the constant temperature at which the experiment was carried out. S. B. S.

Diazo-reaction of Atoxyl. ERCOLE COVELLI (*Chem. Zeit.*, 1908, 32, 1006).—Solutions of atoxyl give the following reactions: (1) with a hypochlorite, a yellow precipitate or coloration; (2) with a hypochlorite, phenol, and ammonia, a blue coloration, which can be observed even in a dilution of 1 : 100,000; (3) with reducing agents, such as zinc and sulphuric acid in the cold, or stannous chloride or hypophosphorous acid in hot hydrochloric acid, a yellow precipitate; and (4) with a fatty aldehyde and a hot mineral acid, a yellow coloration.

More delicate and characteristic reactions are given by arsenodiazobenzene, which is formed when atoxyl is treated with a few drops of a 1/2% solution of sodium nitrite and a few drops of sulphuric acid. The resulting solution gives: (*a*) with *a*-naphthylamine hydrochloride, a purplish-red coloration. This extremely delicate reaction is recommended for the detection of unchanged atoxyl, for example, in urine. Carbamide and the amino-acids, which react with nitrous acid, do not interfere with the test. The reaction may be employed also for the colorimetric estimation of atoxyl; (*b*) with a few drops of acetaldehyde and potassium hydroxide, added drop by drop, a carmine-red coloration, changing to yellow, and finally becoming colourless. The carmine-red is stable in presence of an excess of alkali; and (3) with phenols, such as β-naphthol, abrastol, resorcinol, morphine, or dionine, a purplish-red coloration. Towards biliverdin and pathological urines, which give Ehrlich's diazo-reaction, arsenodiazobenzene behaves in the same manner as sulphodiazobenzene. G. Y.

General and Physical Chemistry.

Refractive Indices of Solutions. FREDERICK H. GETMAN and F. B. WILSON (*Amer. Chem. J.*, 1908, **40**, 468—484).—The specific refraction of various salts, acids, and non-electrolytes in water, calculated on the assumption that the refractive powers of solvent and solute are uninfluenced by the act of solution, have been compared with their specific refractions calculated from atomic refractions.

The lack of agreement in most of the cases studied is supposed to indicate the presence of hydrates in solution, but it has not been found possible to calculate the degree of hydration from the results.

R. J. C.

Refractometric Studies of some Methane Derivatives in which Two or Three Atoms of Hydrogen are Replaced by Negative Radicles. II. Sodium Salts. ALBIN HALLER and PAUL TH. MULLER (*Ann. Chim. Phys.*, 1908, [viii], **15**, 289—296).—Mainly a résumé of work already published (Abstr., 1905, i, 112); the difference between the values of M_D for free acid and sodium salt in the case of ethyl cyanoacetoacetate is 3·74; the acid therefore is a *pseudo*-acid. The possible constitutional formulæ of the sodium salts of the *pseudo*-acids are discussed. M. A. W.

Atomic Decomposition and Spectral Series. AUGUST L. BERNOULLI (*Physikal. Zeitsch.*, 1908, **9**, 745—749; *Ber. deut. physikal. Ges.*, 1908, **6**, 636—642).—The author supposes that the molecules of a gas are not alike, but that the molecular and atomic weights represent average values. On the assumption that every chemical element in the gaseous condition represents a conglomeration of polymerised forms of a primordial matter in equilibrium, and that the gas mixtures obey Rayleigh's radiation law, a formula is deduced from which the atomic weights of the elements can be calculated. The formula is written

$$A = 1{\cdot}0104\left(\frac{-1-\sqrt{3}}{2}\right)^p.\left(\frac{-1+\sqrt{3}}{2}\right)^q,$$

p and q being integral numbers. Using different values of p and q, atomic weight numbers in very good agreement with the experimental values are obtained.

Similar assumptions to the above have led the author to a formula which gives the lines and bands in the spectra of the elements with considerable accuracy. H. M. D.

Flame Spectrum of Cupric Chloride. PETER KIEN (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, **6**, 337—358).—The first part of the paper contains an historical review of previous investigations on the spectrum of cupric chloride; in the second, new experiments are described, the object of which was to determine the intensity and the structure of the bands.

The cupric chloride was introduced into the flame of a blow-pipe fed with coal-gas and air, or oxygen, by means of a roll of filter paper moistened with a solution of the salt. By means of a spring and clockwork mechanism, the filter paper roll was moved up into the flame at a definite rate, and a steady supply of cupric chloride thereby obtained.

The intensity of the spectrum is not greatly influenced by the temperature, but depends very much on the amount of cupric chloride in the flame. As already pointed out by Lecoq de Boisbaudran, four stages of the spectrum, depending on the amount of salt in the flame, can be distinguished. The author's observations agree very well with those of Boisbaudran, except in the fourth stage, when an extremely small amount of salt is present; in these circumstances the only remaining band of any considerable strength reaches from $\lambda = 5100$ to $\lambda = 5800$, and has a maximum at $\lambda = 5400$—5600.

The four characteristic double bands which are seen in the second stage: α ($\lambda = 4259$—4279), β ($\lambda = 4333$—4353), λ (4412—4433), and δ (4493—4515), are found with great dispersion to consist of groups of bands in which series of lines can be recognised.

Attention is called to the sensitiveness of the cupric chloride spectrum. Photographic registration of the "sodium chloride" spectrum in coal or coke fires has confirmed Salet's conclusion that this is due to traces of cupric chloride. H. M. D.

Spectrum of Neo-erbium Oxide and Kirchhoff's Law. KARL A. HOFMANN and GÜNTHER BUGGE (*Ber.*, 1908, **41**, 3783—3789. Compare Hofmann and Burger, this vol., ii, 189).—The reflection spectrum of neo-erbium oxide illuminated by an electric arc light is far more characteristic than the absorption spectrum of a 10% solution of the nitrate, and, in agreement with Kirchhoff's law, it is found that the lines of maximum absorption in the former spectrum correspond with the bright lines in the emission spectrum of the oxide heated with a hydrogen flame. The bands of maximum absorption of the nitrate solution do not exactly correspond with the lines of the oxide spectrum, but are somewhat displaced; thus, the maxima of emission of the oxide are: $\lambda = 661{\cdot}3$, 653·0, 563·4, 540·2, 522·6, 493·0, 489·1, 463·0, and 447·0; the maxima of absorption of the oxide are: $\lambda = 661{\cdot}7$, 652·4, 563·8, 540·4, 522·4, 491·5, 489·5, 462·5, and 446·5; and of the nitrate solution, $\lambda = 667$, 654, 541, 523, 519, 492, 487, 450, and 442. Both the oxalate and fluoride in a solid state give absorption spectra very similar in character to the absorption spectra of solutions of the nitrate and sulphate, although the intensities and positions of the bands vary slightly in each case. Sharp lines as well as bands appear in the absorption spectrum of the solid sulphate, so that a transition of the band spectrum of a salt to the line spectrum of the oxide appears probable. W. H. G.

Spectroscopic Behaviour of Hydrocarbons with Conjugate Ethylene Linkings. JULIUS W. BRÜHL (*Ber.*, 1908, **41**, 3712—3720. Compare Trans., 1907, **91**, 115).—Reif's results (this vol., i, 847) confirm the author's previous conclusions. The values for the refractive dispersions $\Delta^{\beta\delta}$-hexenol and $\Delta^{\beta\delta}$-hexadiene have been re-determined and Reif's results confirmed.

In the latter compound, the values indicate exaltations of + 1·49, + 1·71, and + 0·52 units in the values for $(n_{\alpha}^2 - 1)/(n_{\alpha}^2 + 2) \times P/d$, $(n_{D}^2 - 1)/(n_{D}^2 + 2) \times P/d$, and $M\gamma - M\alpha$ respectively.

Using the formula $(n^2 - 1)/n^2 + 2) \times P/d$, the following values have been calculated for $\Delta^{\alpha\gamma\epsilon}$-hexatriene from W. H. Perkin's numbers:

H_{α}.	D.	$M_{\gamma} - M_{\alpha}$.
30·59	31·03	2·22

which indicate exaltations of 2·07, 2·49, and 1·01 units respectively. These results are striking when compared with the normal optical behaviour of benzene, $\Delta^{1,3,5}$-*cyclo*hexatriene, which shows practically no exaltation. Harries and Majima's $\Delta^{1:3}$-dihydrocymene (this vol., i, 733) also exhibits characteristic exaltations, due to conjugated ethylene linkings.

It is pointed out that the intermediate product described by Auwers and Hessenland (this vol., i, 551) in the preparation of $\Delta^{1:3}$-dihydro-*p*-xylene, and stated to be the corresponding acid, cannot have this constitution, as its methyl ester exhibits no exaltation, but is optically normal. It is suggested that the ethylene linkings in the acid are not in conjugate positions.

Zelinsky and Gorsky (this vol., i, 619) claim to have prepared dihydrobenzenes which give normal molecular refractions and dispersions, although they contain conjugated ethyl linkings. It is pointed out that these authors have not conclusively proved the constitution of their compounds by the examination of decomposition products. J. J. S.

Water of Crystallisation as Affected by Light. Ralph H. McKee and Elvin J. Berkheiser (*Amer. Chem. J.*, 1908, 40, 303—305).—Aniline-*p*-sulphonic acid has been found to lose its water of crystallisation more readily when exposed to light than when kept under exactly similar conditions in the dark. Careful observations showed that, although the temperature of the specimens exposed to direct sunlight was 2·86° lower than those screened from such light by black paper, yet the former lost more than 98% of their water of crystallisation during ten winter days' exposure, whilst the latter only lost 35% during the same period. From determinations of the solubility of the product, no evidence was obtained of any transformation having taken place into the ortho- or meta-compound. When hydrated sulphanilic acid or the product obtained after exposure to sunlight was crystallised from water above 80°, it was found to be in an anhydrous state, whilst from water at 40° the crystals obtained had again $2H_2O$.

J. V. E.

Violet Coloration Produced in Glass by the Influence of Light. J. G. Maschhaupt (*Chem. Weekblad*, 1908, 5, 807—808).—The author attributes the violet colour sometimes developed in the glass of old mirrors to the action of sunlight, and describes experiments in support of his contention. A. J. W.

Some Reflections on Radiology. Albert Reychler (*Bull. Soc. chim.*, 1908, [iv], 3, 1009—1012).—Rutherford and Soddy's theory that radioactive substances consist of unstable, large accumulations of particles of a primordial matter, which are liable to internal changes and decompositions, tending towards closer and more stable arrangements of the particles, does not in the author's view account for all the facts observed, and particularly for (*a*) the large amounts of energy disengaged and (*b*) the conversion of an atom of uranium into several atoms of helium (?) and one atom of radium, which is more voluminous and more active than that of the parent substance.

These difficulties disappear if the ether is taken as the primordial matter, and is regarded as existing in elementary atoms in two forms, namely, condensed, as nodules, an accumulation of which forms the atom, and also in the free state. If the intra-atomic transpositions may then be regarded as involving also the condensation of the free ether, the changes which occur can be represented thus: radium + ether = α-particles + β-particles + emanation. This view would explain the discrepancy between Ramsay and Rutherford's estimates of the length of "life" of a radium atom, that of the former being too short. It implies, however, that radioactive matter enclosed in a glass tube should gain in weight, since the ether would have free access and only β-rays could escape. The β-rays it is suggested, however, may be in part an inflow of electropositive ether.

T. A. H.

Extraordinary Radioactivity of Water from a Spring at Valdemorillo. José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, **6**, 398—400).—Samples of water from a spring at Valdemorillo were found to have radioactivities varying from 27,000 to 51,687 volts per hour-litre. The latter value is remarkably high, and much exceeds that found with the waters from Lerez (10,000—12,000 volts per hour-litre: compare Abstr., 1907, ii, 218; this vol., ii, 750).

W. A. D.

Radioactivity of Three Springs at Oña (Burgos). José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, **6**, 400—402).—The following table shows the character of the rock through which the springs percolate, and the radioactivity of the water and mud therefrom in volts per hour-litre:

	Rock.	Activity of water.	Activity of mud.
Spring *A*	Argillaceous limestone......	34·8	23·6
,, *B*	Cretaceous ,, ...	30·0	99·3
,, *C*	Argillaceous ,, ...	12·8	30·2

Spring *B* is one of considerable volume feeding the river Oca. All three springs come to the surface within a radius of 200 metres from one another. It is probable that all three springs arise from a common source; the difference between the values for the mud of *B* and that from *A* and *C* is probably due merely to the muds being of different consistency.

W. A. D.

Radioactivity of the Gases of the Thermal Spring of Uriage (Isère). Gustave Massol (*Compt. rend.*, 1908, **147**, 844—846).—During the passage of the water through a siphon to the reservoir, very variable quantities of gas are evolved; determinations in two successive half-hours (when a considerable volume of water was flowing) gave 538 litres and 724 litres respectively. Of this gas, 7% is soluble in potassium hydroxide solution (carbon dioxide and hydrogen sulphide), whilst the remainder consists of nitrogen and allied gases. The radioactivity of the gas, as measured by a Curie electroscope (as modified by Chéneveau and Laborde), was 0·150 and 0·144 per 10 litres of gas (at 20° and 745 mm.), the radioactivity of the emanation per minute from 1 mg. of radium being taken as the unit. These results are not strictly comparable with Besson's (following abstract), since the latter refer to the gas dissolved in the water, of which 64·6% is insoluble in potassium hydroxide solution (Lefort found that 1 litre of the water of Uriage contains 3·2 c.c. CO_2, 7·44 c.c. H_2S, and 19·5 c.c. N_2). For the radioactivity of the gas remaining dissolved in the water, the author obtains the value 0·500 per 10 litres. The saline residue left on evaporating the water, the deposit formed in the reservoir, and the rock from which the water flows are all quite inactive. E. H.

Radioactivity of the Waters of Uriage-les-Bains (Isère). Paul Besson (*Compt. rend.*, 1908, **147**, 848—850. Compare preceding abstract).—Three litres of the water were boiled for one hour, the gases evolved being collected over mercury and dried by means of potassium hydroxide and phosphoric acid. After keeping for three hours, the radioactivity of the gas was measured by means of the Chéneveau and Laborde modification of the Curie electroscope. For the gas from 10 litres of water, the values 0·012, 0·015, and 0·018 in mg.-minute units were obtained at pressures of 745 mm., 740 mm., and 735 mm. respectively. Thus the value seems to increase as the atmospheric pressure decreases. This observation of radioactivity in a mineral water containing 6·0567 grams of sodium chloride and 3·311 grams of calcium, magnesium, and sodium sulphates is in accordance with Kofler's work on the solubility of the emanation in saline solutions. The period of half-decay according to Curie's law is four days. The residue left on evaporation is inactive.

The ferruginous water has the very low radioactivity 0·003 mg.-minutes. E. H.

Absorption of the Radioactive Emanations by Charcoal. R. W. Boyle (*J. Physical Chem.*, 1908, **12**, 484—506).—Experiments have been made to determine how the absorbing power of charcoal for the emanations of radium and thorium depends on the conditions.

The absorbing power of charcoal for radium emanation at the ordinary temperature is considerable, but the rate of absorption soon falls off, owing to saturation of the upper layer and the comparatively slow rate of diffusion to the lower layers.

The majority of the experiments were made with thorium emanation. As the rate of decay of the emanation is so great, the observations were made by leading the latter, mixed with air, through tubes containing various absorbing or non-absorbing materials, and estimating its activity by measuring the ionisation of air produced. The results are given in the form of tables and curves, the latter being obtained by plotting the ionisation current against the speed of the air current.

The degree of absorption of the emanation depends: (1) on the speed of the air current, being diminished by increasing the speed; (2) on the nature of the charcoal, being greatest for cocoanut, intermediate for animal, and least for wood, charcoal; (3) on the extent of absorbing surface exposed, being greatest for the most finely-divided charcoal, and (4) is greater the lower the temperature. G. S.

Action of the Radium Emanation on Water. ERNEST RUTHERFORD and T. ROYDS (*Phil. Mag.*, 1908, [vi], 16, 812—818. Compare Cameron and Ramsay, Trans., 1908, **93**, 992).—Preliminary experiments are described, the object of which was to ascertain the minimum amount of neon which can be detected spectroscopically. Small quantities of air were subjected to the action of cocoanut charcoal, cooled by liquid air, and the residual gas introduced into a small spectrum tube, 7 cm. long and 1 mm. in diameter, and examined for neon. Operating on 1/15 c.c. of air, the yellow line of neon is readily observed; with 2/15 c.c. of air, the red lines of neon are clearly visible, and with 1/5 c.c. of air, a brilliant neon spectrum showing most of the lines is obtained. Since, according to Ramsay, one volume of neon is contained in about 100,000 volumes of air, these experiments show that less than one-millionth of a c.c. of neon can be detected spectroscopically.

The gases formed by the action on water of a quantity of emanation, corresponding with the equilibrium amount from 150 mg. of radium, were then examined in a similar manner, after the hydrogen and oxygen had been removed by explosion. A complete and brilliant spectrum of helium was found, but there was no trace of a neon spectrum. In all, five experiments were made; neon was only observed in one case, and was found to be due to a small air leak. The gases obtained from the aqueous solution of the radium salt, from which the emanation had been pumped off, also showed no trace of neon when examined in the same way.

The positive results obtained by Cameron and Ramsay in similar experiments are attributed to the leakage of air into the apparatus used. H. M. D.

Nature of the Positive Rays. WILHELM WIEN (*Sitzungsber. K. Akad. wiss., München*, 1908, 55—65).—Experiments are described the object of which was to find an explanation for the well-known fact that the canal rays are unequally deviated under the influence of a magnetic field. The results indicate that this lack of uniformity cannot be due to the ions having different masses, but is a consequence of differences in the lengths of the paths which they traverse in the charged condition. The nature of the canal rays is determined by a condition of equilibrium, in which the ratio of the charged to the uncharged particles has a constant value. Under the influence of a magnetic field, some of the charged particles are removed, but the condition corresponding with the equilibrium ratio is immediately restored by dissociation of the atoms. H. M. D.

β-Rays of Actinium. OTTO HAHN and LISE MEITNER (*Physikal. Zeitsch.*, 1908, **9**, 697—702).—The β-rays emitted by actinium are not absorbed by aluminium according to an exponential formula. With gradually increasing thicknesses of aluminium, the absorption is at first more rapid than that required by such a formula; in the second stage, the absorption is exponential, whilst in the third, a more rapid rate of absorption is again found. It is found that the increase in the absorption in the third stage is dependent on the experimental arrangements.

The large value of the absorption coefficient for small thicknesses of the absorbing layer is found to be due to the emission of easily absorbed β-rays by radio-actinium. This was separated from the other products of disintegration, and its β-ray activity examined. In addition to β-rays, which are absorbed to the extent of 50% by 0·04 mm. of aluminium, it emits a much more penetrating type of radiation, which consists either of hard β-rays or soft γ-rays.

β-Rays are also emitted by actinium *A* and actinium *C*. The former are absorbed even more readily than the soft β-rays of radio-actinium; the latter are absorbed to the extent of 50% by 0·24 mm. of aluminium.

The view that homogeneous products emit homogeneous β-radiation is confirmed by the results of this investigation. H. M. D.

Influence of Pressure on Ionisation Produced in Gases by the *X*-Rays. The Saturation Current. E. ROTHÉ (*Compt. rend.*, 1908, **147**, 785—788).—A method is described for studying the influence of pressure on ionisation phenomena in general, and details are given of the precautions necessary to secure regular working of the Crookes' tube. The author shows that the intensity of the saturation current is proportional to pressure from 0·1 to 5 atmospheres. W. O. W.

Volatilisation Produced by Canal Rays. JOHANNES STARK (*Zeitsch. Elektrochem.*, 1908, **14**, 752—756).—The canal rays consist of charged or uncharged atoms or molecules projected with great velocity. When such particles strike a metal, they impart their velocity to one or more atoms of the metal, which may rebound with sufficient violence to pass away from the surface of the metal. The consequences of this idea are followed out, and the author thinks that the cathodic volatilisation of metals is better explained in this way than by Kohlschütter's chemical theory (this vol., ii, 457). T. E.

Electromotive Force of Iodine Concentration Cells in Water and Alcohol. ARTHUR P. LAURIE (*Proc. Roy. Soc. Edin.*, 1908, **28**, 382—393; *Zeitsch. physikal. Chem.*, 1908, **64**, 615—628).—Measurements are recorded of the *E.M.F.* of concentration cells consisting of platinum wires immersed in differently concentrated solutions of iodine in aqueous and alcoholic potassium iodide.

For aqueous solutions in which the iodine concentration is small, the observed values of the *E.M.F.* of the concentration cell are in good agreement with those calculated from Nernst's equation when the free iodine concentrations are determined from the equilibrium constant corresponding with the dissociation equation : $KI_3 \rightleftharpoons KI + I_2$. For more concentrated solutions, the observed values differ sensibly from those obtained by calculation.

Similar relationships between the two series of numbers are found in the case of alcoholic solutions, and the conclusion is drawn that Nernst's equation also applies to these solutions and that they contain potassium tri-iodide like the aqueous solutions.

Measurements in aqueous alcoholic solutions show that the *E.M.F.* of a given concentration cell increases as the proportion of alcohol in the mixture increases.

When solutions containing equal quantities of iodine and potassium iodide in water and alcohol respectively are opposed to one another, a considerable *E.M.F.* is obtained. The action of the cell involves the transference of iodine from the aqueous to the alcoholic solution, and the transference of potassium iodide in the reverse direction. In both cases the transference is towards the solvent in which the substances dissolve more readily. H. M. D.

Explanation of Supertension. III and IV. Felix Kaufler (*Zeitsch. Elektrochem.*, 1908, **14**, 737—741, 749—752).—In consequence of Müller's criticism (this vol., ii, 802), the author has made measurements of the difference of potential between lead or smooth platinum cathodes and a solution of acetophenone or benzophenone in aqueous alcohol containing potassium acetate during electrolysis. These show that, under the same conditions, the fall of potential between the solution and the cathode is greater with lead than with platinum.

The resistance of a cell with a mercury cathode and an anode of platinum or of lead in which the electrolyte is sulphuric acid of maximum conductivity is measured during the passage of a current. With a low current density (under 0·05 ampere per sq. cm.) the attainment of a steady condition is extremely slow. The resistance of the cell is much larger than that observed with no current flowing ; it is greatest with small current density, and is not dependent on the nature of the anode. Stirring the mercury does not change the resistance. As in the case of lead previously investigated (this vol., ii, 558), the author assumes the existence of a film of a hydride of high resistance on the surface of the mercury. The product of film resistance and current, which is the supertension due to the transition resistance at the surface of the cathode, is approximately independent of the current density and varies from 0·05 to 0·1 volt.

T. E.

Influence of the Velocity of Ionic Reactions on the Current-Potential Curve. Arnold Eucken (*Zeitsch. physikal. Chem.*, 1908, **64**, 562—580).—The relation of current and potential has been studied in the double cyanides of potassium with silver, gold, copper, and mercury, but only the first of these allows of the production of a limiting current independent of the potential. The velocity of dissociation, $Ag(CN)_2' \rightarrow Ag^{\cdot} + 2(CN)'$, is very great. The finite velocity observed by Caspari (Abstr., 1900, ii, 7) is due to a secondary reaction. The smaller the velocity of the ionic reaction the smaller is the limiting current.

The velocity of dissociation of acetic, lactic, and benzoic acids has been calculated from the results of previous observers. C. H. D.

Ionisation Constants of the Secondary Hydrogen Ion of Dibasic Acids. Rudolf Wegscheider (*Zeitsch. Elektrochem.*, 1908, **14**, 740—741).—A claim of priority against Chandler (this vol., ii, 467). T. E.

Specific Charge of the Ions Emitted by Hot Substances. Owen W. Richardson (*Phil. Mag.*, 1908, [vi], **16**, 740—767).—The ratio of the electric charge to the mass of the positive ions emitted by hot substances has been determined by measurements of the deflexion of the path, due to the action of a transverse magnetic field on the ions when moving in a uniform electric field.

The experimental data indicate that the ratio of the mass to that of the hydrogen atom is the same for the ions from carbon and platinum, and this is very nearly equal to the corresponding quantity determined by J. J. Thomson for the ions from iron. The values are respectively: for platinum, 25·7; for carbon, 27·6; and for iron, about 24.

These numbers show that the positive ions cannot be atoms of the metal or atoms of absorbed hydrogen; neither can they be regarded as identical with the positive electrons found by Thomson in the canal rays.

The emitted ions appear to be quite homogeneous, and experiments carried out between 750° and 1200° indicate that the ratio of charge to mass does not depend on the temperature of the hot substance in any simple way.

The mass ratios in terms of hydrogen are not very different from the molecular weights of nitrogen, carbon monoxide, and oxygen, but there is no evidence that the different substances evolve one or other of these gases when heated. The author, on the other hand, thinks it possible that the positive ionisation is due to a real constituent which is common to the different elements examined. In this case it is necessary to assume that the ions carry a charge which is smaller than the generally recognised fundamental electronic charge. H. M. D.

Determination of the Hydration of Ions by Transference. Experiments in the Presence of a Non-electrolyte. Edward W. Washburn (*Tech. Quart.*, 1908, **21**, 288—320).—Experiments have been made to determine the transference of water which accompanies the migration of ions in aqueous solution by the measurement of transport numbers in presence of a third constituent, or reference substance, which remains stationary during the passage of the current. By referring the changes in concentration of the water and of the electrolyte to this third substance, the amounts of each transferred are calculated, and from these "true" transference numbers have been obtained.

Sucrose, raffinose, and arsenious acid were used as reference substances, the first two substances being estimated polarimetrically, the third by means of an iodine solution. The behaviour of arsenious acid is uncertain, on account of its ready oxidisability. A description of the transport apparatus has been previously given (this vol., ii, 805).

The experimental data show that the electrolysis of solutions of potassium, sodium, or lithium chloride containing one of the above reference substances is attended by an increase in the ratio of the quantity of non-electrolyte to that of water at the anode, and by a corresponding decrease at the cathode. It is shown that this is due chiefly, if not wholly, to a transfer of water from the anode to the cathode. From the measured changes, the relative degrees of hydration of the chlorine, lithium, sodium, and potassium ions have been calculated. On the assumption that the chlorine ion is not hydrated, the minimum hydration values of the cations have been calculated; these correspond with the formulæ: $K(H_2O)_{1\cdot3}$, $Na(H_2O)_{2\cdot0}$, and $Li(H_2O)_{4\cdot7}$. From Buchböck's data for hydrochloric acid solutions, the minimum hydration value for the hydrogen ion corresponds with $H(H_2O)_{0\cdot3}$. Absolute values for the hydration cannot be obtained until the hydration value of some one ion has been determined by some other method.

On account of this transference of water during electrolysis, the transport numbers hitherto obtained for more concentrated solutions of the alkali metal chlorides are erroneous. The true transference numbers are found to vary with the concentration much less than the apparent values obtained by the ordinary Hittorf method.

The true values are also given by the method of moving boundaries, and the author's data are found to agree very well with the results of Denison and Steele obtained by this method.

H. M. D.

Variation of the Degree of Dissociation of Certain Electrolytes with Temperature.

Adolfo Campetti (*Atti R. Accad. Sci. Torino*, 1908, **43**, 1071—1094).—The author has determined the conductivities, the temperature-coefficients of conductivity, and the degrees of dissociation of solutions of zinc and magnesium sulphates and of sulphuric acid for temperatures varying from 10° to 90° and for concentrations 3·0—0·001*N*.

The variation of the dissociation with the temperature is, as far as its sign is concerned, in agreement with van't Hoff's law. For an interval of concentration which is not too great, the degree of dissociation is best expressed as a function of the concentration by van't Hoff's formula: $K = a^{3/2}c^{1/2}/(1-a)$, the expression given by Rudolphi, $K = a^2c^{1/2}/(1-a)$, yielding somewhat less concordant results.

Integration of van't Hoff's formula, $q = -RT^2/K.dK/dT$, assuming that the heat of dissociation, q, per gram-molecule is constant for the temperature interval, $T_2 - T_1$, leads to the expression $q(T_1 - T_2)/T_1T_2 = 4\cdot58[\log\{a_2^2/(1-a_2)\} - \log\{a_1^2/(1-a_1)\}]$, which is found to be approximately true with magnesium sulphate and with sulphuric acid.

In solutions of magnesium sulphate or zinc sulphate, the undissociated molecules give rise to complex molecules.

T. H. P.

Conductivity and Ionisation of Electrolytes in Aqueous Solutions as Conditioned by Temperature, Dilution, and Hydrolysis. Harry C. Jones and C. A. Jacobson (*Amer. Chem. J.*, 1908, **40**, 355—410. Compare Abstr., 1905, ii, 794).—So many conflicting results have been published on the question of the influence of temperature on dissociation that the authors were induced to re-investigate the subject. The method employed was that previously described by Jones and West (Abstr., 1905, ii, 794), the temperature at which observations were made also being the same. Twenty-eight inorganic salts and six organic acids have been investigated; the molecular conductivity and percentage of dissociation at 0°, 10°, 25°, and 35° at eight dilutions are tabulated, also the temperature-coefficients in each case. The results are in agreement with the well established facts that (1) the molecular conductivity of electrolytes increases with rise of temperature; (2) the conductivity increases with increase in dilution up to a certain maximum value; (3) dissociation increases with increase in dilution up to the point of complete dissociation. At the somewhat low temperatures of these observations, no maximum in the conductivity curve, as described by Sack, Kohlrausch, and Noyes, was observed. Further, it was found that the conductivity of water increases as a linear function of the temperature, but the molecular conductivity of electrolytes in aqueous solution increases as a parabolic function of the temperature from 0° to 35°. The increase in conductivity of electrolytes causing the departure from a straight line is largely due to their being more or less hydrated; the rise in temperature diminishes the extent of this hydration, allowing the ions to move with less friction, and thus show an increase of conductivity. In support of this view, those salts which are strongly hydrated in solution are found to exhibit a greater increase in conductivity with rise of temperature than the salts that are slightly hydrated. The conclusion is also drawn from the results given that nearly all, if not all, electrolytes are hydrolysed in dilute solutions, and this greatly influences the true dissociation value. When the temperature-coefficients expressed as conductivity units are examined, they are all found to increase as the dilution increases, and for every salt they increase with rise of temperature; but the organic acids, on the other hand, have decreasing temperature-coefficients with increase of temperature. J. V. E.

Basicity of Acids as Determined by their Conductivities. M. R. Schmidt (*Amer. Chem. J.*, 1908, **40**, 305—313).—After considering the work of Miolati and Mascetti (Abstr., 1901, ii, 381) on the effect of alkalis on the conductivity of solutions of various acids, and the anomalous behaviour of hydrogen fluoride solutions in this connexion (Pellini and Pegoraro, Abstr., 1907, ii, 860), the author gives his results of a study of the conductivity change when potassium hydroxide is added to moderately strong solutions of phosphoric acid. Working with 0·2*N*, 0·1*N*, 0·04*N*, and 0·02*N* solutions of phosphoric acid, it was found that in the case of 0·2*N* solutions, the minimum occurs when only about 40% of the amount of potassium hydroxide required for one-third neutralisation had been added. In the more dilute solutions, the minimum shifts continually towards the point corresponding with the salt KH_2PO_4, reaching it with 0·02*N* solutions. As a possible explanation of this, it is suggested that, as more and more potassium hydroxide is added, the $\overset{+}{H}$ ions of the phosphoric acid are replaced by $\overset{+}{K}$ ions, which move more slowly, and, as a result, the conductivity of the mixture decreases. But phosphoric acid being far from completely dissociated in strong solutions, when a small quantity of base is added, practically all the hydrogen ions present are neutralised. Immediately, however, more dissociate, and in sufficient quantity to overbalance the decrease in conductivity caused by the substitution of $\overset{+}{K}$ ions for the $\overset{+}{H}$ ions, thus causing the conductivity to rise again.

A minimum thus appears before enough alkali has been added to form the primary salt. Furthermore, as the dilution increases, the phosphoric acid becomes more and more completely dissociated according to the formulation $H_3PO_4 \rightleftarrows \overset{+}{H} + (H_2\overset{-}{P}O_4)$, thus lessening the overbalancing effect of secondary dissociation previously mentioned.

J. V. E.

Comparative Investigations on the Formation of Salts and the Basicity of Acids. GIUSEPPE BRUNI (*Zeitsch. Elektrochem*, 1908, **14**, 729—734).—The molecular conductivity of an acid of which a fraction x is neutralised is $\Lambda = x(l_M + l_A) + (1-x)\alpha(l_H + l_A)$, where l_M, l_A, and l_H, are the mobilities of the metallic ion, the anion, and the hydrogen ion respectively, and α is the fraction of the acid which is dissociated. The salt is supposed to be completely dissociated. Assuming that the acid follows Ostwald's dilution law, α can be expressed in terms of known quantities. This gives an expression for the conductivity which reproduces all the peculiarities of the curves obtained by the author (this vol., ii, 935).

T. E.

Certain Phenomena in Gases Subjected to the Action of Spark Discharge or Arc Light. HEINRICH RAUSCH VON TRAUBENBERG (*Physikal. Zeitsch.*, 1908, **9**, 713—726).—Measurements have been made of the electrical conductivity of certain gases during, and after, the passage of electricity through them in the form of a spark discharge and of direct and alternating current arcs. The gases examined were hydrogen, oxygen, acetylene, carbon dioxide, air, coal gas, and carburetted hydrogen. The high conductivity, which is observed during the period of the spark or arc discharge in all cases, persists for several hours after the discharge is stopped in the case of acetylene and coal gas. The phenomenon was investigated more closely in the case of coal gas, and found to depend on the material of the electrodes, and on the nature of the discharge. In some cases the conductivity, which is unipolar in nature, was found to decrease slowly, whilst in others it increased. No evidence of a saturation current could be obtained. The last part of the paper is devoted to a theoretical discussion of the possible modes of electrical transport through the conducting gases. H. M. D.

Hysteresis of Certain Iron Compounds. G. BERNDT (*Physikal. Zeitsch.*, 1908, 9, 750—752; *Ber. deut. physikal. Ges.*, 1908, 6, 662—666[*]).—The magnetic properties of ferric oxide, ferric hydroxide (impure), ferric chloride, and ferrous and ferric sulphates have been examined. The oxide and hydroxide exhibit well-developed hysteresis; in the case of the salts, no such effect could be detected. As the strength of the field increases, the magnetic susceptibility of the oxide diminishes considerably, and that of the hydroxide slightly.

H. M. D.

Magnetic Properties of the Oxygenated Metallic Radicles. P. PASCAL (*Compt. rend.*, 1908, **147**, 742—744. Compare this vol., ii, 756, 927).—By measuring the magnetic susceptibilities of their solutions, the author has obtained the following values for the molecular magnetic susceptibilities at 23°: of manganese sulphate, $+1500\times10^{-5}$; potassium permanganate, $+25{\cdot}5\times10^{-5}$; chrome alum, $+2\times629\times10^{-5}$; chromic acid, $-0{\cdot}5\times10^{-5}$; vanadium chloride, $+139\times10^{-5}$; sodium metavanadate, $-30{\cdot}2\times10^{-5}$. Comparison of each pair of salts shows that oxidation of the metal results in a diminution in the magnetic susceptibility; the molybdates and ferrates also, unlike the salts of molybdenum and iron, are diamagnetic.

The values for vanadium compounds: VCl_2, $+139\times10^{-5}$; $(V_2O_2)SO_4$, $2\times115\times10^{-5}$; vanadium tetrachloride (hydrolysed) $(=V_2O_4)$, $+66{\cdot}2\times10^{-5}$, and $NaVO_3$, $-30{\cdot}2\times10^{-5}$, indicate that the magnetic properties of the vanadium ion diminish in proportion to the increase in the degree of oxidation; similarly, $U(SO_4)_2$ has $+320\times10^{-5}$, and $UO_2(SO_4)$, $-5{\cdot}57\times10^{-5}$.

These examples indicate the increasing generality of the law previously enunciated, that when the chemical properties of a metal become masked by its entry into a complex ion or colloid, the magnetic properties are similarly affected and to the same degree. An interesting example of this is afforded by vanadic anhydride, which dissolves in concentrated sulphuric acid to a red solution. The latter on dilution becomes first yellow and then colourless. The anhydride in the red solution has the molecular magnetic susceptibility $-2\times85{\cdot}7\times10^{-5}$; in the yellow solution, $-2\times31{\cdot}5\times10^{-5}$, and in the colourless solution, $-2\times30{\cdot}2\times10^{-5}$. From these values, it is permissible to conclude that the strongly acid solutions contain red sulphovanadic compounds which dissociate on dilution. These complexes doubtless include Berzelius' vanadyl sulphate, $VO_2(SO_4)_3$, Ditte's compound, $V_2O_5,3H_2SO_4$, and Gerland's salt, $4SO_3,V_2O_5,K_2O$.

E. H.

Measurements with Gas Thermometer. ARTHUR L. DAY and J. K. CLEMENT (*Amer. J. Sci.*, 1908, **26**, 405—463).—The authors have endeavoured to improve the accuracy of the nitrogen in platinum standard gas thermometer between 0° and 1200°.

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[*] and *Ann. Physik*, 1908, [iv], **27**, 712—734.

Particular attention was paid to uniformly heating the bulb by a series of independently regulated platinum coils whilst the unheated space between bulb and manometer was reduced to a minimum.

The whole furnace being contained in a bomb in which nitrogen was maintained at the same pressure as the thermometer, diffusion and strain on the bulb were obviated, so that much higher gas pressures could be employed than hitherto. The coefficient of expansion of the metal of the bulb was determined with great care.

The melting points of the purest commercially obtainable metals are given as follows: zinc, 418·5° ± 0·1; silver, 958·3° ± 0·5; gold, 1059·3° ± 1·0; copper, 1081·0° ± 0·5. Exact analyses of the metals are given, but different samples of ostensibly the same metal sometimes differed by 1° in melting point. It is claimed that the determinations of temperature are accurate to within half a degree. R. J. C.

Heat of Fusion, Specific Cohesion, and Molecular Weight at the Melting Point. PAUL WALDEN (*Zeitsch. Elektrochem.*, 1908, **14**, 713—724).—For non-associated substances, the ratio L/a^2 is roughly a constant and equal to 3·6 (L = heat of fusion, and a^2 the height to which the liquid rises in a capillary of 1 mm. radius at the melting temperature). The expressions ML/T and Ma^2/T (M = molecular weight, and T absolute melting point) are also roughly constant for non-associated substances. The value of the former is 13·5, and that of the latter, 3·65. For associated substances, the degree of association may be obtained by dividing the value of the expression for any substance into the above constants. The results are in harmony with values obtained by other methods. By combining these results with Trouton's rule and van't Hoff's equations for the depression of freezing point and elevation of boiling point of solutions, it is shown that $E_1/E = 0·64T_1/T$ and $L/L_1 = 0·64T/T_1$, where E_1, T_1, and L_1 are the molecular elevation of boiling point, the absolute boiling point, and the heat of evaporation of a liquid, E, T, and L being the corresponding quantities at the freezing point. The application of the equations to some metallic and non-metallic elements and fused salts gives values for the degree of association which agree with what is known on other grounds about the size of their molecules. T. E.

Electrical Heating in Ebullioscopic Determinations and in Fractional Distillation. ERNST BECKMANN (*Zeitsch. physikal. Chem.*, 1908, **64**, 506—507. Compare this vol., ii, 663; also Richards and Mathews, this vol., ii, 828).—When, in spite of electrical heating, superheating and bumping occur in ebullioscopic determinations, the difficulty can be got over by passing a current of an indifferent gas through the liquid.

An apparatus is sketched in which electrical heating has been successfully employed for the fractional separation of the chlorides of sulphur. In this way the chloride SCl_2 has been distilled off almost pure at −24° under a pressure of 4 mm. J. C. P.

Quartz Protecting Tubes in Thermal Analysis. P. Schoen (*Metallurgie*, 1908, 5, 635—637).—Quartz tubes are to be preferred to porcelain for the protection of thermo-couples in the determination of freezing points of alloys, on account of their greater cheapness, and of the less resistance to the passage of heat. They are also less permeable than porcelain to metallic vapours. They are, however, more readily attacked by oxides. They can be used up to nearly 1500°, at which temperature they soften. C. H. D.

Cryoscopic Investigations on Solutions of Gases in Liquids. Pietro Falciola (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 324—330).—The author has extended the investigations of Garelli and Falciola (Abstr., 1904, ii, 312) to the gases, carbon monoxide, nitrogen, hydrogen, oxygen, methane, and nitrous oxide, and to other solvents than those previously employed.

With water or formic acid, carbon monoxide produces a depression of the freezing point, whilst with acetic acid, benzene, and a number of other organic solvents, the freezing point is raised. Similar elevation of the freezing point of certain solvents is also produced by nitrogen, hydrogen, oxygen, and methane, but is not observed with carbon dioxide, hydrogen sulphide, acetylene, or nitrous oxide.

Benzene, the freezing point of which has been raised by means of carbon monoxide, assumes its normal freezing point gradually in the cold, but rapidly on heating. Bromoform, however, through which carbon monoxide or nitrogen has been passed, maintains its elevated freezing point for some days if kept in the dark and out of contact of the air. The phenomenon does not appear to be due to chemical action, but is probably caused by part of the gas adhering to the solvent and separating with the latter in the solid state.

The following table gives the coefficients of absorption of the various gases, calculated from the equation $c = m\Delta/k$.

	H_2.	O_2.	N_2.	CO.	CH_4.	N_2O.
Water	—	—	—	0·0222	—	—
Formic acid ...	0·0064	0·2057	0·495	0·0600	0·2285	—
Acetic acid......	0·0041	0·164	0·1153	—	0·0328	0·891
Benzene	—	—	—	—	0·2286	—
Nitrobenzene ...	—	—	—	—	—	0·2926

T. H. P.

An Electrically Heated Oven, with a Liquid Regulator. L. Ehrmann (*Bull. Assoc. chim. Sucr. Dist.*, 1908, 26, 272—274).—The apparatus described was constructed for the purpose of maintaining a moderately low temperature in an oven. An ordinary electric lamp is used as the source of heat, and the temperature is regulated by means of a tall cylindrical vessel containing very dilute sulphuric acid. A glass tube carrying a platinum wire is inserted through a cork in a tubulure at the bottom of the cylinder, and a long glass tube carrying a second platinum wire is passed through a cork at the top of the cylinder. This upper tube is made to move freely through the cork, so that the distance between the upper and lower platinum wires may be adjusted as desired. The cylinder is inserted in the circuit feeding the lamp, and by altering the distance between the platinum wires the degree of heat obtained from the lamp may be regulated as desired. A second form of regulator is also described. It consists of a glass vessel containing the acidified water, and in the latter are placed two copper plates, one fixed and the other movable, the method of using this regulator being similar to that mentioned above. In both cases, means are provided for changing the direction of the current from time to time in order to prevent polarisation. W. P. S.

Thermodynamics of Salts containing Water of Crystallisation. Hermann Schottky (*Zeitsch. physikal. Chem.*, 1908, **64**, 415—448).—The author applies Nernst's theory (Abstr., 1907, ii, 153) to the case of formation of a higher hydrate from a lower one and water, and deduces from it the relationship $Q - A = T(C - C')$, where Q and A are referred to the combination of 1 molecule of water, C is the molecular specific heat of ice, and C' is the heat capacity of the combined molecule of water of crystallisation. For the purpose of testing this formula, the values of Q and $C - C'$ are obtained from thermochemical data, and A is calculated from the tension of the vapour over the hydrates.

The four cases selected for examination are: (1) $CuSO_4 + H_2O = CuSO_4,H_2O$; (2) $K_4FeCy_6 + 3H_2O = K_4FeCy_6,3H_2O$; (3) $BaCl_2 + H_2O = BaCl_2,H_2O$, and (4) $BaCl_2,H_2O + H_2O = BaCl_2,2H_2O$.

In order to supplement the few data already available in these cases, the author has determined (1) the specific heats of the hydrates; (2) the heats of hydration; (3) the dissociation pressures. The values obtained differ in some cases from those recorded by earlier investigators, and are employed to show that the formula $Q - A = T(C - C')$ is qualitatively correct in all four cases, and that for (1) and (3) it is capable of quantitative verification within the limits of experimental error. In the other two cases, the quantitative validity of the formula is only approximate.

The difficulty of determining the dissociation pressures of salt hydrates is discussed, and various forms of apparatus suitable for the determination are described. The sluggishness with which the maximum tension is reached is connected with the character of the efflorescing surface.

The theoretical and experimental work of Johnston (this vol., ii, 358) are adversely criticised. J. C. P.

Thermochemical Equivalence, and the Thermochemistry of Nitrogen. John C. Thomlinson (*Chem. News*, 1908, **98**, 226. Compare Abstr., 1907, ii, 153).—In the belief that the numbers given previously may actually represent the thermal changes taking place, the author calculates from the structural formula he gives for nitrogen pentoxide and nitric acid an approximate heat of formation of 12,504 cal. and 45,447 cal. respectively. The experimental values are 13,000 cal. and 41,600 cal. J. V. E.

Apparent Deviations from Mariotte's Law and their Influence on the Measurement of Small Pressures. Karl Scheel and Wilhelm Heuse (*Physikal. Zeitsch.*, 1908, **9**, 784—789; *Ber. deut. physikal. Ges.*, 1908, **6**, 785—793).—The discrepancies between the results of previous measurements of the compressibility of gases at low pressures have led the authors to examine the influence of a variation in the ratio of the exposed surface to the volume of the containing vessel in the case of air. In order to obtain a very large surface, one of the containing vessels was filled with about 20 grams of glass wool. For a variation in pressure from 0·07 to 0·7 mm. of mercury, *pv* remained constant in the absence of the glass wool, but when this was present, *pv* was found to diminish as the pressure was increased. After drying the glass wool by exhausting the apparatus, and leaving in contact for some time with phosphoric oxide, the variation in *pv* could no longer be observed.

The authors conclude that the deviations from Boyle's law which Baly and Ramsay found when air was compressed at low pressures in capillary tubes are due to the presence of a film of condensed water on the surface of the glass containing vessels; when this is removed, the apparent deviations disappear, and the same results are obtained whether the gas is compressed in vessels with a small or with a large amount of exposed surface.

It is pointed out that when the McLeod gauge is used for the measurement of small pressures, all traces of water vapour must be removed from the gas and from the walls of the glass vessel.

H. M. D.

Viscosity and Fluidity. EUGENE C. BINGHAM (*Amer. Chem. J.*, 1908, **40**, 277—280. Compare Abstr., 1906, ii, 218).—It is found with pure liquids that the fluidities of unassociated substances are approximately a linear function of the temperature, the relation being expressed by the formula $t_1 = A\phi + K_1$, where t is the temperature absolute, ϕ the fluidity, and A and K_1 are constants. Associated compounds, however, especially the alcohols, depart widely from the linear type, except at high temperatures, when the fluidity curves approximate to a straight line. To represent the increase in temperature required to give the fluidity ϕ on account of the association of the substance, use is made of the expression $t_2 = K_2 - B/\phi$, where B and K are constants. Added together, these two equations become $t = t_1 + t_2 = A\phi - B/\phi + C$, which, when tested with Thorpe and Rodger's data (Trans., 1897, **71**, 374) for substances not highly associated, gives results in closer agreement with observed facts than does Slotte's equation. With associated substances, such as acids, alcohols, and water, fairly close agreement is also observed. An approximate equation containing four constants, $t = A\phi - B/(\phi + D) + C$, is also used; it gives with associated substances results in as close agreement with observed values as does the above simpler equation with unassociated substances. Tables comparing the values for hexane and water, calculated by the various equations, are given.

J. V. E.

Anomalies in the Viscosity of Emulsions and of Anisotropic Liquids. EMIL BOSE (*Physikal. Zeitsch.*, 1908, **9**, 707—708).—The changes observed in the viscosity of anisaldazine in the neighbourhood of the clearing point (this vol., ii, 258) cannot be used as a proof against the emulsion theory of anisotropic liquids. On the other hand, Vorländer's experiments (this vol., i, 641) indicate that this theory is untenable. H. M. D.

Influence of Electrolytes on the Viscosity of Colloidal Liquids. MANFREDI ALBANESE (*Arch. exp. Path. Pharm., Suppl.*, 1908, 16—28).—The viscosity of an aqueous solution of gum arabic is lowered (up to 30%) by the addition of electrolytes, but not by other substances. Solutions of certain other colloids, such as egg-albumin, are not affected by electrolytes, unless they have been dialysed previously, in which case the viscosity is somewhat diminished by adding salt. G. B.

Capillary Properties of Aqueous Solutions of Fatty Acids. BOHDAN VON SZYSZKOWSKI (*Zeitsch. physikal. Chem.*, 1908, **64**, 385—414. Compare this vol., ii, 827).—In contrast with the usually accepted view, the author finds that the heights to which water and fatty acid solutions rise in capillary tubes are almost independent of accidental impurities. For the purest water obtainable, for ordinary distilled water, for conductivity water, and for tap-water, the observed capillary rise is the same to within 0·1 mm. It is also found unnecessary to take special precautions in protecting the capillary tubes from dust; washing out with chromic acid mixture is quite adequate preliminary treatment.

The acids specially examined were *n*- and *iso*-butyric acids, *n*- and *iso*-valeric acids, and *n*- and *iso*-hexoic acids, and the experiments show that the higher an acid stands in the homologous series the greater is its effect in lowering the capillarity of water; the effects of the *n*- and *iso*-acids are nearly equal. In the case of *iso*butyric acid, the variation in the capillarity with concentration is satisfactorily reproduced by the empirical formula $y = 1 - b\log(x/a + 1)$, where a and b are constants, x is the concentration, and y is the capillary rise referred to that of water as standard. The other acids examined obey this dilution law only approximately.

In most cases there are considerable differences between the author's measurements and those recorded by Drucker (Abstr., 1905, ii, 680); this is probably to be attributed to the different purity of the acids employed.

Some experiments made on the relative influence of *iso*valeric acid and its barium salt, and on the effect produced by mixtures of the two, support the view that the depression of the capillarity of water is to be attributed to the undissociated part of the acid.

Experiments made with mixtures (1) of *iso*butyric and *iso*valeric acids, and (2) of *iso*butyric and *iso*hexoic acids, indicate that the depression of the capillarity of water is an additive property for the fatty acids. In the first case, this fact may be made the basis of an analytical determination of the mixed acids. J. C. P.

Osmotic Pressure. JOHANNES J. VAN LAAR (*Zeitsch. physikal. Chem.*, 1908, **64**, 629—632).—The formula for the osmotic pressure of a perfect solution proposed by Lewis (this vol., ii, 465) is identical with that obtained by the author (Abstr., 1895, ii, 107; 1906, ii,

526) on thermodynamic grounds. The formula obtained in this way is valid for imperfect, as well as for perfect, solutions, and is in accordance with the experimental results of Morse and Frazer (Abstr., 1905, ii, 475; 1906, ii, 600, 601). C. H. D.

The Vapour Pressure and Osmotic Pressure of a Volatile Solute. HUGH L. CALLENDAR (*Proc. Roy. Soc.*, 1908, *A*, **81**, 336).—If an osmotic membrane is impermeable to the solute, the formulæ for the change of vapour pressure with hydrostatic pressure, and for osmotic pressure, are the same for a volatile as for a non-volatile solute. If, on the other hand, the membrane is permeable to the vapour, but not to the liquid phase, the equation depends on the concentration of the constituents in the vapour phase. C. H. D.

Osmotic Pressure of Sucrose Solutions at 15°. HARMON N. MORSE and B. MEARS (*Amer. Chem. J.*, 1908, **40**, 194—213. Compare Abstr., this vol., ii, 671).—In order to ascertain the cause of the osmotic pressure of sucrose solutions at 0° not being in agreement with the gas pressure, as at 20°, measurements at intermediate temperatures have been made. The authors now give results of measurements made at 15°, and from a comparison with those obtained at 0°, 5°, and 10°, previously recorded (*loc. cit.*), they are able to state that sucrose solutions exhibit a temperature-coefficient which is practical identical with the temperature-coefficient of gases. J. V. E.

Electric Osmosis. JOSEPH C. W. FRAZER and HARMON N. HOLMES (*Amer. Chem. J.*, 1908, **40**, 319—325).—A description is given of the apparatus used, and also the results of a preliminary investigation of the relative osmosis of a few salts of nitric acid at the concentration 0·001*N*. The observations recorded for nine different salts appear to support the statement made previously (Abstr., 1906, ii, 600) that the osmosis of the nitrates of alkalis and alkaline earths varies inversely as the velocity of the cation divided by its valency, but the osmosis does not seem to be proportional to the specific resistance of the solutions.

It is suggested that some connexion may exist between this phenomenon and the results obtained by Kohlrausch (Abstr., 1903, ii, 403) and others working on the hydration of ions. J. V. E.

Improvement in Cells for the Measurement of Osmotic Pressure. HARMON N. MORSE and B. MEARS (*Amer. Chem. J.*, 1908, **40**, 266—277).—A detailed account is given of the weak points of the cell previously used and described (Abstr., 1905, ii, 575); the paper deals, however, in general with the form of cells and the method of closing them for the measurement of osmotic pressure. A new form of cell is described, which is entirely free from the objectionable features of the older one. The upper end of it is glazed inside and out, and has an accurately ground conical aperture at the top for the reception of a brass, cone-shaped collar, which is covered with a caoutchouc cap carrying the manometer tube. The closing of this cell is rapidly effected by screwing a brass nut down on to the collar. For details of construction and manipulation, the original must be consulted. J. V. E.

Improved Manometers for Measurement of Osmotic Pressure. HARMON N. MORSE and B. F. LOVELACE (*Amer. Chem. J.*, 1908, 40, 325—337).—An apparatus is described by means of which manometers may be compared with others, or with the standard, up to pressures of three hundred atmospheres. Corrections for meniscus, and a method of detecting a temporary or a permanent stretch of the manometer, are also given, as well as a detailed description of the method used by the authors for filling and closing their manometers. J. V. E.

The System Water, and Sodium, Barium, and Copper Chlorides. FRANS A. H. SCHREINEMAKERS and W. C. DE BAAT (*Chem. Weekblad*, 1908, 5, 801—806).—The authors represent the quaternary system water, sodium chloride, barium chloride, and copper chloride by means of a regular tetrahedron, the four angles giving the four components. The method is an extension of that employed to represent a ternary system by means of an equilateral triangle. A. J. W.

Velocity of Reactions in Gases Moving through Heated Vessels, and the Effect of Convection and Diffusion. IRVING LANGMUIR (*J. Amer. Chem. Soc.*, 1908, 30, 1742—1754).—In studying the changes which take place in mixtures of gases while passing through hot tubes, the velocity coefficient of the reaction is usually calculated by means of the formula derived for reactions occurring in stationary gases. Bodenstein and Wolgast (this vol., ii, 162) have pointed out that this method is inaccurate, since allowance is not made for the mixing of the gases in the tube by diffusion or convection, and they have presented a formula which holds when the mixing of the gases can be considered complete.

In the present paper, these two formulæ and the magnitude of the error arising from their application in various cases are considered. New formulæ are developed, from which the velocity coefficient may be calculated in cases in which neither of the formulæ mentioned holds good, but in which, in the mixing of gases, diffusion plays a more important part than convection. E. G.

Relation between the Velocity of Reaction and the Velocity of Stirring in Non-homogeneous Systems. K. JABŁCZYŃSKI (*Bull. Acad. Sci. Cracow*, 1908, 620—631).—The rate of dissolution of a solid in a liquid increases with stirring. The connexion between the velocity constant k and the velocity of the stirrer n is given by the empirical equation $k_1/k_2 = (n_1/n_2)^x$, where x is a constant, the value of which varies with different apparatus, and even with the same apparatus if taken apart and put together again. This probably accounts for the different values of x obtained by different investigators (Bruner and Tolloczko, Abstr., 1903, ii, 470; Bruner, Abstr., 1904, ii, 315; Sackur, Abstr., 1906, ii, 261). The evaluation of x is important, since it gives some information as to how far a reaction in a non-homogeneous system is dependent on diffusion (Noyes and Whitney, Abstr., 1897, ii, 479; Nernst, Abstr., 1904, ii, 315). In the same apparatus, so arranged that each experiment can be completed without any disturbance of the parts of the apparatus, the author has examined, at 25°, the solution of a marble plate in hydrochloric acid, the decomposition of hydrogen peroxide by platinised platinum foil, and the solution of a fused zinc plate in hydrochloric acid. The average values of x are 0·93, 0·55, and 0·28 respectively. Hence the author deduces that, for the dissolution of a solid with a perfectly smooth surface, the velocity constant of the reaction is simply proportional to the velocity of stirring (as measured by the revolutions of the stirrer); if the surface of the solid is not smooth, the increase of the velocity constant is slower than the increase of the velocity of stirring, and the more so the rougher the surface. C. S.

Saponification of Glycerides during Ester Exchanges in Homogeneous Systems. ROBERT KREMANN (*J. pr. Chem.*, 1908, [ii], **78**, 364—367); MILAN J. STRITAR and RICHARD FANTO (*ibid.*, 408).—Polemical (compare Abstr., 1907, i, 464; this vol., i, 120, 499; ii, 677). G. Y.

Oxidations of Biological Importance. I. HANS EULER and IVAN BOLIN (*Zeitsch. physiol. Chem.*, 1908, **57**, 80—98).—Careful experiments have been made on the oxidation of quinol by oxygen in the presence of manganous salts and alkali. It is shown that the velocity of the reaction is almost proportional to the pressure of the oxygen, and that the temperature-coefficient is very small between 0° and 40°. The solutions used were either neutral or slightly acid to phenolphthalein. To obtain such solutions, it is necessary to add dilute alkali, as quinol is decidedly acidic. The effect of the manganese (added as acetate) and of the sodium concentrations has been studied. As the whole reaction cannot be represented by means of the usual unimolecular formula, owing to the fact that part of the quinol is removed in the form of insoluble quinhydrone, the velocity has been determined by measuring the times required in the different experiments for absorbing a given volume (3 or 5 c.c.) of oxygen. The results show that in neutral or slightly acid solutions, manganese salts accelerate the oxidation, and that if the amount of sodium hydroxide added is the same, the rate of oxidation increases less rapidly than the manganese concentration. On the other hand, if the amount of manganese salt is constant, the velocity increases much more rapidly than the amount of alkali added.

The relationship between the effects of the manganese salt and the alkali is compared with that of an enzyme and co-enzyme.

Similar experiments have been made with "laccase" and manganese salts. It is shown that the laccase as prepared by Bertrand's method is slightly acid, and that it has no action on a quinol solution in the absence of manganese salts. It is obvious that the action of the laccase cannot be due to its alkaline nature, as suggested by Dony-

Hénault. Even the addition of 10 c.c. of 0·0001*N* hydrochloric acid to lucerne laccase does not affect the activity of the laccase in the presence of manganous salts.

It is further shown that the active principle of the laccase is not a substance of the enzyme type, as the preparations of laccase can be boiled for three minutes without destroying their activity in the least.

It is shown that salts of hydroxy-acids, for example, rochelle salt, sodium citrate, calcium gluconate, and sodium mucate, accelerate the oxidation of quinol in a marked manner when manganese salts are present, and it is suggested that laccase owes its activity to the presence of such salts. J. J. S.

Some Oxydasic Phenomena Produced by Colloidal Ferrous Ferrocyanide. JULES WOLFF (*Compt. rend.*, 1908, **147**, 745—747. Compare this vol., i, 137, 490 ; ii, 573).—In a feebly alkaline solution, colloidal ferrous ferrocyanide acts as an oxydase towards quinol. When a saturated solution of quinol is treated with ammonia to the extent of 1 part in 25,000, and colloidal ferrocyanide to the extent of 1 part of iron in 100,000, abundant crystals of quinhydrone are formed after twelve to fifteen minutes, oxidation being accelerated by shaking. The reaction is still observed with one-twenty-fifth as much iron if the quantity of alkali is increased to 1 part in 2000. Solutions of quinol treated with alkali alone become brown, but rarely deposit crystals, the colloidal iron alone has no action. If too much alkali (1%) is added, the solution is rapidly oxidised by the air, and no crystals are formed. These phenomena can be explained by the alkali facilitating the oxidation of the phenol, and consequently the action of the ferrocyanide, which thus acts as an oxydase. This view is supported by the facts that if the alkali is added some time before the colloidal iron, quinhydrone is no longer obtained, and that, other things being equal, the intensity of the reaction is proportional to the amount of alkali present (within the limits described above). From the latter observation, it would be expected that the alkali-earth oxides and hydrogen carbonates, and feebly alkaline salts, such as disodium hydrogen phosphate, would exercise a much less energetic action. This is actually found to be the case. The important part played by the alkali suggests that the oxidising action on quinol of certain manganese salts with weak acids discovered by Bertrand (Abstr., 1897, ii, 493) is due partly to their alkalinity, all of them being alkaline to methyl-orange. The author finds that the addition to these solutions of a quantity of iron in the form of colloidal ferrocyanide, one-hundredth as great as that of manganese present, suffices to double the rate of oxidation of quinol, and that neutral aqueous manganese sulphate solutions, which are ordinarily almost inactive, increase their activity considerably when treated with traces of pyridine (which does not precipitate manganese). E. H.

Catalysis. IX. Catalytic Reactions induced by Enzymes. SALOMON F. ACREE (*J. Amer. Chem. Soc.*, 1908, **30**, 1755—1760).—Attention is drawn to the work of Hudson (this vol., i, 605, 856) on the inversion of sucrose by invertase, and it is shown that it harmonises completely with the view already advanced by others, that the addition of an enzyme to a reacting system brings about a catalytic reaction, owing to the union of the enzyme with some constituent or "substratum" of the reacting system to form a new product which gives the same end-products as the substratum itself. It is pointed out that this theory of catalysis through the formation of reactive intermediate compounds renders the assumption of a vital energy for such reactions unnecessary. E. G.

Molecular State of Molten Salts. RICHARD LORENZ and FELIX KAUFLER [in part, A. LIEBMANN] (*Ber.*, 1908, **41**, 3727—3738).—The molecular weights of lead chloride, potassium nitrate, sodium nitrate, and silver chloride in the fused state at various temperatures between 300° and 600° have been determined by measuring the surface tension of the molten salt. The mean values of K obtained for potassium nitrate and sodium nitrate, namely, 0·7 and 0·25 respectively, are in fair agreement with those recorded by Bottomley (Trans., 1903, **83**, 1421). The constants found for silver chloride and lead chloride were respectively 0·8 and 0·9. Since these values are all less than 2·12, the constant for liquids having a normal mol.-wt., the conclusion is drawn that the salts investigated exist in the fused state in a highly associated condition and that the ions are of a complex nature.

W. H. G.

Liquid Crystals. OTTO LEHMANN (*Ber.*, 1908, **41**, 3774—3783).—Mainly a historical review of the author's investigations on the subject of liquid crystals.

The view recently put forward by Vorländer (this vol., i, 641), that pseudo-isotropic, crystalline liquids are to be regarded as uniaxial crystals, is combated. It is possible for a biaxial mass to become pseudo-isotropic, that is, apparently uniaxial. W. H. G.

The Liquid-crystalline State as a General Property of Matter. P. P. VON WEIMARN (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 166—168*).—Having shown in previous papers (this vol., ii, 90, 263) that the colloidal-amorphous state of matter is a modification of the crystalline, the author has now studied certain liquid crystals, such as *p*-azoxyphenetole, both microscopically and ultramicroscopically, and states his views of the nature of these crystals as follows. A liquid crystal is a system of chemically or physically associated, solid, crystalline particles, between which vectorial forces of small tension act. The small magnitude of the tension in the case of chemical association is conditioned by the considerable energy expended in building up the complicated molecule in the case of physical association by the expenditure of energy requisite for the association of a number of elementary crystalline particles to one particle. G. S.

Theory of Colloids. EDUARD JORDIS (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 153—166).—A summary of the author's views on the nature of colloidal solutions (compare Abstr., 1907, ii, 344; this vol., ii, 675).

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* and *J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1323—1327.

The theory developed is in many respects identical with that of Duclaux (summarised in *J. Chim. Phys.*, 1907, **5**, 29), and many of Duclaux's results are discussed in detail. Pure hydrosols are not stable; the stability is determined by small amounts of other substances, usually electrolytes, which act as "sol-formers." These substances are in chemical combination with the dissolved colloids, and when they are completely removed, the hydrosol coagulates.

G. S.

Electrical Nature of Colloidal Solutions. NICOLA PAPPADÀ (*Gazzetta*, 1908, **38**, ii, 474—480. Compare Abstr., 1907, ii, 754).—The author criticises Duclaux's hypothesis concerning the electrical nature of colloids (compare Abstr., 1904, ii, 162, 243, 325; 1905, ii, 432, 511; 1906, ii, 660, 677; this vol., ii, 760). T. H. P.

Influence of Colloids on the Absorption of Gases, especially of Carbon Dioxide in Water. ALEXANDER FINDLAY [with W. H. HARBY] (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 169—170).—The absorption of carbon dioxide by blood is not well understood, and it is suggested, in agreement with Wolfgang Ostwald (this vol., ii, 509), that, besides ordinary chemical combination, adsorption on the surface of the colloidal particles may be of importance in this connexion. As the first step in an investigation of the effect of colloids on the solubility of gases, the solubility of carbon dioxide in colloidal solutions of ferric hydroxide, gelatin, arsenic sulphide, silicic acid, albumin, dextrin, soluble starch, and glycogen has been measured at 25°. The first two colloids increase the solubility, the three last mentioned diminish it somewhat, and the other three are without effect.

G. S.

Colloidal Silver (Silver-gel) in Photographic Layers. LÜPPO-CRAMER (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 170—174).—For the direct production of positives as employed in ferrotype photography, it is necessary that the silver in the parts which are most strongly lighted should be obtained in a more or less white form. This can now be effected with dry collodion plates covered with colloidal substances, such as tannin or gum.

In order to study the deposition of silver in different forms, silver bromide plates have been exposed in a Chapman Jones "plate tester," which allows of graduated illumination. When a plate thus exposed is developed with ferrous oxalate, the silver varies in appearance from greyish-white, on the most highly exposed parts, to greyish-black, on the parts almost in shade, and the difference persists after fixing. The white silver has a much smaller adsorptive power than the black form, and this difference in properties is employed to account for certain phenomena occurring in photographic processes. G. S.

Freezing of Hydrosols. O. BOBERTAG, KARL FEIST, and H. W. FISCHER (*Ber.*, 1908, **41**, 3675—3679).—The paper gives a review of the behaviour of colloidal solutions at temperatures below the freezing point of the solvent. By rapid cooling to −70°, the metal is separated from Bredig's colloidal suspension of platinum. By freezing a colloidal solution of arsenic trisulphide, Winter (Abstr., 1905, ii, 245) obtained the solid red modification, the authors cool a very dilute solution to −70°, and, after thawing, recover the yellow colloidal solution, which, however, has become very turbid. Colloidal ferric hydroxide, cooled to −70° and thawed, remains clear, but shows a distinct augmentation of the Tyndall phenomenon. Aluminium acetate behaves somewhat similarly. The colloidal silver preparations, protargol, collargol, and lysargin, in the presence of albumin are dark coloured, very turbid, and optically non-homogeneous; by freezing, the silver collects into small lumps, which are distributed irregularly through the clear ice; on thawing, the solution is recovered apparently unchanged.

In connexion with organic colloids, certain dyes and substances of animal and vegetable origin have been examined. Rhodamine, chrysoidine, eosin, and safranine form true solutions; Nile-blue, acid-violet, methyl-violet, and magenta behave as semi-colloids, and night-blue, alkali-blue, Congo-red, and benzopurpurin as pronounced colloids (compare Freundlich and Neumann, this vol., ii, 820; Höber and Chassin, *ibid.*, ii, 875).

On cooling a 10% solution of tannin, a considerable deposition is observed just above the freezing point; on thawing the frozen mass, the tannin partly dissolves, the remainder going into solution by slight warming. Hæmoglobin (Merck), after being cooled to −10°, −70°, and −180°, shows no apparent change. Solutions of gum or starch, cooled to the same temperatures and thawed, are quite turbid, but clarify by keeping. Dried albumin in solution, cooled to −70° to −180° and thawed, gives a turbid solution, which does not again clarify entirely. Solutions of gelatin, caragheen moss, agar-agar, and soap behave in a similar manner on freezing. The water is mostly frozen out from the jelly, so that the first portion of the liquid obtained by thawing is practically free from dissolved substances. After complete thawing, the product is decidedly non-homogeneous, consisting of a mobile liquid and a clotted jelly.

Attempting to explain the varying behaviour of the preceding colloidal solutions on freezing, the authors suggest that the freezing causes the colloidal particles to become aggregated, and that these aggregations may be partly or entirely destroyed by thawing, with the result that a precipitation or a solution is obtained. C. S.

Study of Colouring Matters in Solution. Louis Pelet-Jolivet and A. Wild (*Compt. rend.*, 1908, **147**, 683—685; *Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 174—177; *Bull. Soc. chim.*, 1908, [iv], **3**, 1087—1094). —From a study of the electrical conductivity and the ultramicroscopic state of solutions of various dyes (magenta, methylene-blue, crystal-violet, safranine, crystal-ponceau, naphthol-yellow S, Congo-red, etc.), the conclusion is drawn that dyes are dissociated in aqueous solution into two ions, and that some of them assume the colloidal condition. Addition of electrolytes favours the passage into the colloidal state. The authors' results do not entirely agree with those of Teague and Buxton (Abstr., 1907, ii, 933) and of Freundlich and Neumann (this vol., ii, 820). J. C. C.

Fixation of Different Derivatives of the Same Colouring Matter and Explanation of Dyeing. Louis Pelet-Jolivet and N. Andersen (*Compt. rend.*, 1908, **147**, 808—810.* Compare preceding abstract).—Wool was placed in solutions containing equivalent quantities of derivatives of certain basic and acidic colouring matters. Other conditions being the same, the hydrochloride of safranine gave a paler tint than the sulphate, and the phosphate a darker tint. The hydroxide gave a tint intermediate between the sulphate and phosphate. The sodium salt of crystal-ponceau produced lighter tints than the magnesium salt; the aluminium salt gave darker tints, whilst the free acid was intermediate between the two latter salts in colouring power.

These experiments confirm the theory of Freundlich and Loser (Abstr., 1907, ii, 155, 534) of the fixation of basic and acidic dyes. The wool is supposed to become negatively charged when placed in water; when treated with a solution of the salt of a basic dye, adsorption of the positively charged organic ion occurs, whilst in the case of the salt of an acidic dye, the positive inorganic ion is adsorbed, causing the fabric to assume a positive charge, which, being smaller than the negative charge produced by an equivalent quantity of a negative dye, accounts for the well-known fact that wool and charcoal fix basic dyes more readily than acidic ones. This accords, moreover, with the effects produced by adding electrolytes to the bath, since positive multivalent ions or hydrogen ions should favour the fixation of the acidic dyes, whilst negative ions should hinder the process. A rational explanation is thus afforded of the action of mordants and of the tanning process.

W. O. W.

Passive State of Metals. Review of the Literature and Theories and Some Experiments on Cobalt, Iron, and Nickel. Horace G. Byers (*J. Amer. Chem. Soc.*, 1908, **30**, 1718—1742).—A historical and theoretical discussion is given of the work done hitherto on the passivity of metals. Experiments are described which have been carried out with cobalt, iron, and nickel. A plate of the metal connected with a copper conducting wire was suspended as anode in a porous cup, which was placed in a porcelain beaker. Both beaker and cup were nearly filled with solutions of the various electrolytes. The cathodes, two platinum plates of the same size as the anode, were suspended in the beaker parallel to, and at equal distances from, the anode. The amount of the anode dissolved during the passage of the current was measured by its loss of weight.

The results obtained were so varied and conflicting as to render a brief summary impossible. Iron, nickel, and cobalt cannot be rendered passive by the hydrogen acids or their salts. Passivity may take place in electrolytes containing oxygen, and depends on the current density, the temperature, the electrolyte, and the treatment of the metal. The metals may be either passive or active under exactly the same current conditions so long as the current density is below a critical value.

The phenomena of passivity have not yet received any satisfactory explanation. Faraday's view, connecting passivity with the formation of a coating of oxide on the metal, is untenable. The hypotheses of

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* and *Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 206—210.

Finkelstein and Müller, according to which the passive state is occasioned by changes in the valency of the metal, are unsatisfactory. Many of the results now obtained cannot be reconciled with Fredenhagen's explanation, which attributes passivity to anodic oxygen or an oxygen alloy. E. G.

Determination of the Atomic Weight of the Simple Ponderable Substance, Pantogen. Gustave D. Hinrichs (*Compt. rend*, 1908, **147**, 797—800. Compare this vol., ii, 573, 574).—The author assumes the existence of a simple fundamental material of atomic weight 1/128, and thence proceeds to theoretical deductions as to the weight and geometrical forms of the atoms of hydrogen, helium, nitrogen, oxygen, and fluorine. The paper includes a diagrammatic representation of the atoms of these elements, and of their physical properties in the neighbourhood of the absolute zero.

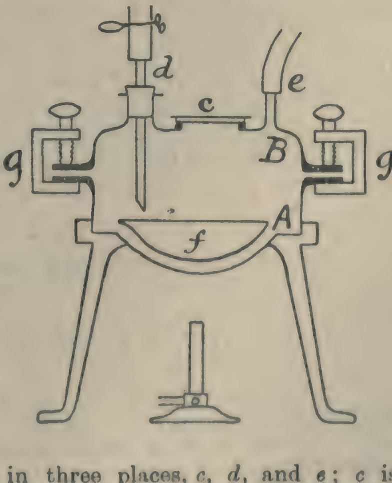
H. O. W.

Atomic Weight of Radium and Other Elementary Substances. Henry Wilde (*Phil Mag.*, 1908, [vi], **16**, 824—830. Compare Abstr., 1907, ii, 149; this vol., ii, 141).—The author still maintains that the true atomic weight of radium is 184. A periodic table is given, based on the numerical relationships previously described.

H. M. D.

New Form of Test-tube Holder. H. Stoltzenberg (*Zeitsch. angew. Chem.*, 1908, **21**, 2272).—The advantage of the new form of wire holder described lies in the fact that, not only may the tube or other object held be readily released, but the force by which it is held may be increased by the power of the hand. It thus becomes possible to lift fairly heavy vessels and to shake them without fear of their falling. J. V. E.

Apparatus for Evaporating in a Dish under Reduced Pressure. Eduard Donath (*Chem. Zeit.*, 1908, **32**, 1107).—The accompanying figure depicts the apparatus described by the author. It consists of two parts, *A* and *B*, both being made of stout copper having thick, broad flanges so as to form an air-tight chamber when they are screwed down on to an asbestos washer by screws, *g*. Into the lower part, *A*, the evaporating basin, *f*, is placed upon asbestos fibre. The upper part, *B*, is perforated in three places, *c*, *d*, and *e*; *c* is covered by a thick plate of transparent mica, the liquid to be evaporated is introduced through *d*, and *e* is connected to an exhaust pump. J. V. E



Circulating Pump. H. Stoltzenberg (*Zeitsch. angew. Chem.*, 1908, **21**, 2271—2272).—A new form of small centrifugal pump is described as being an efficient circulator of liquid from a thermostat through condensers, jacketed polarimeter tubes, etc. The power required to drive the pump is very small, and when rotating at 1200 revolutions per min. it is able to lift water to a height of ten metres.

J. V. E.

Inorganic Chemistry.

[Production of Hydrogen Peroxide from Persulphuric Acid.] Consortium für Elektrochemische Industrie (D.R.-P. 199958).—When carefully-purified solutions of persulphuric acid are treated with sulphuric acid (D 1·4) at 50—80°, the former rapidly yields hydrogen peroxide with a loss of only 3 or 5% of oxygen. This result is, however, only obtained in the absence of all impurities likely to decompose hydrogen peroxide catalytically (compare Trans., 1904, **85**, 1526—1533). G. T. M.

Generation of Oxygen in a Kipp's Apparatus. Ludwig Wolter (*Chem. Zeit.*, 1908, **32**, 1066).—The extremely vigorous evolution of oxygen from alkali peroxides when treated with water or dilute acids has been sufficiently modified by admixture with indifferent substances to allow of the generation of the gas in a Kipp's or other gas generation apparatus by this method.

The best results have been obtained with a substance prepared by adding a mixture of 100 parts of sodium peroxide and 25 parts of magnesium oxide to 100 parts of molten potassium nitrate. This, when solidified and broken into pieces of a suitable size, is placed in a Kipp's apparatus and treated with dilute hydrogen chloride. The substance may be kept for some time ready for use by dipping the lumps into molten paraffin wax so as to protect them from the atmosphere.

J. V. E.

Dynamic Allotropy of Sulphur. I. Hugo R. Kruyt (*Zeitsch. physikal. Chem.*, 1908, **64**, 513—561).—The investigations of Smith and his collaborators (Abstr., 1903, ii, 139, 284; 1905, ii, 382, 580; 1906, ii, 157; 1907, ii, 20; this vol., ii, 32) have led to results which accord best with the theory that $S\lambda$ and $S\mu$ are partly miscible in the liquid state, but that the equilibrium curve lies entirely outside the heterogeneous region. Smith's conclusion, that the equilibrium curve cuts the curve of miscibility, is untenable. A bibliography and review of previous literature on the subject are given.

The melting point of rhombic sulphur was determined by immersing capillary tubes containing the powdered sulphur in boiling calcium chloride baths at different temperatures, and was finally fixed at

112·4°. Similar sulphur, heated for an hour at 90° in ammonia to produce equilibrium, melted at 110·9°. The unstable "natural melting point" of rhombic sulphur was then found graphically to be 110·5°, and the melting point of pure rhombic sulphur 112·8°. From 111° onwards, the melting-point curve must be parallel to the concentration axis.

The composition of the vapour in contact with liquid sulphur at different temperatures was measured by blowing a current of air through the molten sulphur at constant temperature, and condensing the current of vapour on the surface of water at 0°. Ammonia gas was introduced as a catalyst, this being subsequently removed by the current of air, the sulphur dioxide formed by partial oxidation then serving to preserve the composition of the vapour unchanged during cooling. The condensed sulphur was analysed by extraction with carbon disulphide. The vapour and liquid curves intersect at 324° and 24·7% $S\mu$.

The vapour-pressure curve of the system $S\lambda$—$S\mu$ presents either a maximum or a minimum, but it is not yet possible to determine which. This point is to be further investigated. This curve must cut the curve of equilibrium. C. H. D.

The Boiling Point of Sulphur on the Constant Pressure Air Thermometer. NICHOLAS EUMORFOPOULOS (*Proc. Roy. Soc.*, 1908, *A*, **81**, 339—362).—A detailed account of measurements with a Callendar air thermometer of Jena glass. The various sources of experimental error were very fully investigated, the most important being the changes of volume of the glass bulbs. The mean value of the boiling point of sulphur obtained is 443·58°. C. H. D.

The Boiling Point of Sulphur. HUGH L. CALLENDAR (*Proc. Roy. Soc.*, 1908, *A*, **81**, 363—366. Compare preceding abstract).—The changes of volume in glass render it an unsuitable material for accurate thermometry. The value for the boiling point of sulphur obtained by Eumorfopoulos is in close agreement with those obtained by other methods, the chief source of error being now the uncertainty as to the true coefficient of expansion of mercury. C. H. D.

Preparation of Hydrazine. FRITZ RASCHIG (D.R.-P. 198307).—When excess of strong aqueous ammonia reacts with a solution of sodium hypochlorite in the presence of an organic substance to increase the viscosity of the solution, a good yield of hydrazine is obtained. One litre of sodium hypochlorite and 12 c.c. of a solution containing 5% of joiners' glue are added to 3 litres of concentrated aqueous ammonia, the solution heated to drive off ammonia, and concentrated to the crystallising point, when 80—90 grams of hydrazine sulphate are obtained on the addition of sulphuric acid. The product is purified by crystallisation. G. T. M.

Hydroxylamine. I. ERICH EBLER and E. SCHOTT (*J. pr. Chem.*, 1908, [ii], **78**, 289—342).—The authors review the various formulæ which have been proposed for hydroxylamine, and assemble the evidence in favour of the view that it is a tautomeric substance, having in alkaline solution the constitution $NH_2\cdot OH$, and acting as an acid, but in acid solution behaving as an oxonium base, $NH_3\colon O$, forming salts of the type $NH_3\colon O<^{H}_{X}$. This view of the nature of hydroxylamine is applied to the explanation of its properties and of the reactions which it undergoes.

Anhydrous hydroxylamine is readily prepared by dissolving 4—5 grams of the 75% distillate obtained by Uhlenhuth's method (Abstr., 1900, ii, 475) in 100—400 c.c. of absolute alcohol, and cooling the solution to about $-18°$. Hydroxylamine is deposited from the stronger solutions in white leaflets, and from the more dilute solutions slowly in needles.

Lobry de Bruyn found (Abstr., 1892, 1391) that hydroxylamine reacts with zinc, forming zinc oxide and ammonia. It is now shown that the intermediate product of this reaction is a zinc salt, $Zn(O\cdot NH_2)_2$, and not an additive compound, $Zn\colon O\colon NH_3$. A similar calcium salt has been prepared, and indications obtained of the existence of an extremely unstable ferric salt. It is proposed to apply the term hydroxylamites to the salts $NH_2\cdot OM'$, $(NH_2\cdot O)_2M''$, etc.

Calcium hydroxylamite, $Ca(O\cdot NH_2)_2$, is formed with evolution of gas when calcium filings are treated with anhydrous hydroxylamine at 50°. Ammonia is evolved only if heat is developed, which takes place if water is present. The white salt, which separates towards the end of the reaction, is extremely explosive, being much more dangerous than anhydrous hydroxylamine; when washed with absolute alcohol and dried in a vacuum over sulphuric acid, it is obtained as a white, amorphous powder, which detonates at 180°, and is hydrolysed by water, slowly by moist air, forming calcium hydroxide and hydroxylamine. It is considered that Hofmann and Kohlschütter's calcium salt of hydroxylamine (Abstr., 1898, ii, 380) is a mixture of calcium hydroxylamite and calcium hydroxide.

Zinc hydroxylamite, $Zn(O\cdot NH_2)_2,3NH_3O$, prepared by the action of anhydrous hydroxylamine on finely-divided pure zinc and treatment of the product with absolute alcohol, is obtained in glistening crystals, loses hydroxylamine, and leaves a residue of zinc oxide when gradually heated, detonates, evolving ammonia, when quickly heated, and is readily hydrolysed by moisture, forming zinc hydroxide.

Haber observed (Abstr., 1898, ii, 23) that hydroxylamine oxidises ferrous salts in ammoniacal or sodium carbonate solution, and stated that the hydroxylamine is itself converted into ammonia. It is now found that under these conditions nitrogen and nitrous oxide are first evolved, ammonia appearing only towards the end of the reaction. The study of the reaction is complicated by the fact that hydroxylamine is decomposed catalytically by ferric hydroxide in neutral or alkaline solution, yielding the same three products. The ferric hydroxide residue is scarlet, becomes brownish-red when heated, does not decolorise permanganate or evolve chlorine from hydrochloric acid, and thus resembles the ferric hydroxide residue obtained from the catalytic decomposition of hydrogen peroxide. If hydroxylamine is treated with ferric hydroxide in absolute alcoholic solution at about $-18°$, a brown precipitate is formed, which, after being washed with absolute alcohol, decomposes on treatment with water, forming nitrogen, nitrous oxide, and ammonia, and must therefore contain *ferric hydroxylamite.*

Hydroxylamine silicofluoride, $(NH_3O)_2,H_2SiF_6,2H_2O$, prepared by adding 16% aqueous hydrofluosilicic acid to a 25% aqueous solution of hydroxylamine and allowing the mixture to evaporate, crystallises from boiling methyl alcohol in scales, and is almost insoluble in alcohol, but readily dissolves in water.

Hydroxylamine titanofluoride, $(NH_3O)_2,H_2TiF_6$, prepared by adding 20% hydroxylamine to a cooled solution of hydrofluotitanic acid and evaporating the solution in a vacuum, separates from methyl alcohol in white crystals. With quadrivalent titanium, hydroxylamine gives the same yellow coloration, caused by the formation of a higher oxide of titanium, as is produced by hydrogen peroxide. G. Y.

The Interaction of Nitrous Gases and Oxygen with Water. FRITZ FOERSTER and M. KOCH (*Zeitsch. angew. Chem.*, 1908, 21, 2209—2219. Compare this vol., ii, 941).—In continuation of this investigation (*loc. cit.*), the authors have studied the behaviour towards water of nitric peroxide when greatly diluted with air. The results, which are tabulated, show the proportion of nitric peroxide converted into nitric acid to be greater when the concentration of this gas in the gaseous mixture is greater; it is, however, not directly proportional, being considerably less than would be expected. This may be explained by the fact that with large excess of air the nitrous acid represented in the equation $H_2O + 2NO_2 \rightleftharpoons HNO_3 + HNO_2$, being less stable in solution, allows of a more rapid absorption of fresh nitric peroxide than when the excess of air is less. It is also shown that with diluted nitric oxide the increased concentration of nitric acid is not due simply to absorption of more oxides of nitrogen, but, in part, to the nitric acid formed previously leaving the solution with water as HNO_3,H_2O. The limiting concentration at the ordinary temperature at which this takes place is indicated by the following: with 1% NO_2, about 46% HNO_3; with 2% NO_2, about 51·8% HNO_3, and with 5% NO_2, more than 55·6%.

From a study of the influence of a large excess of air on the behaviour of the nitrous acid produced in the primary change, it is shown that it completely decomposes, with time, into nitric acid and nitric oxide. Excess of oxygen, when not at the same time under a smaller partial pressure, rapidly oxidises this nitric oxide to nitric peroxide, but, in the case of a large excess of air, there is insufficient time for the nitric oxide that is carried forward from the water solution to be completely oxidised to the peroxide. The quantity of nitric oxide escaping oxidation was ascertained by substituting for the water, dilute alkali hydroxide solution as absorbent, and the quantity of nitrite produced is shown to be greater when the dilution by air is greater.

Nitric peroxide, even when largely diluted by air, is rapidly oxidised by ozone to nitrogen pentoxide, and when such a gaseous mixture is passed into water, or aqueous nitric acid, an acid solution containing more than 80% HNO_3 may readily be obtained.

J. V. E.

Formation of Colloidal Phosphorus. Alfred Lottermoser (*J. pr. Chem.*, 1908, [ii], **78**, 367—368).—When exposed to diffused daylight in a closed vessel, a clear, colourless solution of white phosphorus in contact with solid white phosphorus gradually becomes opalescent and orange-yellow by reflected, but clear and yellowish-red by transmitted, light. The hydrosol thus formed is unstable, and, after some time, deposits a scarlet crust of red phosphorus on the glass walls of the vessel. The formation of the hydrosol must result from the conversion, under the influence of the diffused light, of the dissolved white phosphorus into the red modification, which is almost insoluble in ether, and separates, therefore, at first in the colloidal form. The strong yellow colour of the hydrosol supplies further evidence that the light red colour of the red phosphorus depends on the finely-divided state of the latter. So soon as red phosphorus is deposited on the walls of the vessel, the solution is free from the hydrosol, partly because the colloid is completely precipitated and partly because the deposit protects the remaining white phosphorus from the action of light.

G. Y.

Ionisation by Phosphorus and Phosphorescence. Léon Bloch and Eugène Bloch (*Compt. rend.*, 1908, **147**, 842—844).—It has been shown previously (Abstr., 1905, ii, 72) that the air which has passed over phosphorus is the seat of a true ionisation, and the ions produced have a small mobility. It is now found that when an air current of greater velocity is employed, the phosphorescence becomes elongated in the direction of the current, and with a further increase in the velocity, definitely separates itself from the phosphorus with the production of a dark space. The phosphorus generally retains a slight phosphorescence, but this disappears finally when the velocity is sufficiently augmented. If the tube is sufficiently long, the phosphorescence which assumes the form of a phosphorescent column can be removed several metres from the phosphorus by regulating the air-current. A condenser placed in or beyond, but not before, the phosphorescence becomes charged, whilst an iodide-starch paper (test for ozone) becomes blue in the positions in which the condenser is charged. It is thus shown that the phosphorescence, ionisation, and ozone are produced in the same region, and therefore that the three phenomena are produced, not by the oxidation of the phosphorus itself, but of some substance emanating from it. This might be either phosphorus vapour or phosphorous oxide. From the results obtained by Jungfleisch (Abstr., 1905, ii, 244) and by Schenk, Mihr, and Banthien (Abstr., 1906, ii, 326), the latter supposition seems the more probable. This view is also supported by the observation of the authors, that if the dark space is cut suddenly, phosphorescent bubbles are formed, which travel slowly in opposite directions, disappearing either on collision or, more rarely, of their own accord.

If the dark space contains phosphorous oxide, which is spontaneously inflammable, this phenomenon is explained, the movement of the luminous bubbles being the propagation of explosive waves.

The transformation of phosphorus into phosphoric oxide is a vivid combustion, and it is therefore to be expected that the ions produced would be of the same nature as in other cases of combustion. The analogy between the large ions of phosphorus and those of the gases of flames has been pointed out by Bloch and by Harms (Abstr., 1904, ii, 331), who finds an increase in the mobilities as the phosphorus is approached. The latter result is confirmed by the authors, who obtain values up to 0·1 mm. close to the phosphorus. The mobilities can, however, be greatly increased (up to 2—3 mm.) by inserting a cotton plug beyond the phosphorus to retain the fumes formed on the latter. It seems, therefore, that the phosphorus ions are produced by the combustion of the phosphorous oxide, and rapidly rendered heavy by the presence of liquid or solid particles. E. H.

Sublimation of Arsenic. W. P. A. JONKER (*Chem. Weekblad*, 1908, **5**, 783—785).—The sublimation point of arsenic determined by the aid of a thermopile is 616°/760 mm. A. J. W.

The Luminosity of the Bunsen Flame. BURRITT S. LACY (*Zeitsch. physikal. Chem.*, 1908, **64**, 633—640. Compare Haber and Richardt, Abstr., 1904, ii, 166).—In order to study the cause of the luminosity in the inner zone, the author has introduced methane into a separated Bunsen flame, 5 mm. above the summit of the inner cone, without producing any effect on the luminosity. Special experiments were made to eliminate the cooling effect of the current of methane. The results are in accordance with Haber and Richardt's view, that the production of the light is a luminescence phenomenon. The presence of methane in the middle zone of the separated flame was confirmed.

The constant $k=[H_2O]\,[CO]/[CO_2]\,[H_2]$ was found to be the same whether the gases were taken from a zone just above the green cone or from a higher zone at a temperature 300° lower, being about 3·7. A catalytic influence of the platinum tube used was, however, observed. C. H. D.

Precipitated Silica. HENRY LE CHATELIER (*Compt. rend.*, 1908, **147**, 660—662).—The existence of hydrates of silica is questioned on account of the variable amounts of water revealed by analysis. When gelatinous silica, purified from electrolytes by diffusion, was heated in a sealed tube at 320° for six hours, no change in appearance or consistency could be detected. The author draws the conclusion that silica, like chromium trioxide, does not form hydrates, but on account of its absolute insolubility remains in an extremely fine state of division when precipitated. Freshly-precipitated gelatinous silica in distilled water may be used to polish hard substances, such as bronze. R. J. C.

Products of the Arc and Spark Electric Discharge in Liquid Argon. FRANZ FISCHER and GEORGE ILIOVICI (*Ber.*, 1908, **41**, 3802—3810).—If compounds of argon are capable of existence, they are probably endothermic, and might be produced at a high temperature and afterwards be preserved by sudden cooling, as in the formation of ozone in liquid oxygen (compare Abstr., 1907, ii, 163, 340). Cadmium was used for the electrodes, and with the spark discharge, after three hours in liquid argon, 3·3 mg. of an olive-green substance, and with the arc after 140 minutes, 22·7 mg. of a black substance, were obtained. These, on examination, proved to contain cadmium nitride, but mixed with cadmium in the case of the arc product. The spectrum of the gas obtained by heating these substances in a vacuum showed the lines of nitrogen, hydrogen, cadmium, and mercury, with some lines of argon, and the gas obtained by the action of phosphoric acid on the substance gave hydrogen, mercury, and argon lines —nitrogen could not be detected, but the product after the action contained ammonia. The nitrogen must have been derived from small traces of air in the argon used.

The spectroscopic examination was carried out in tubes fitted with aluminium electrodes, previously heated at 150° to expel gases. The tube gradually became "hard," and the nitrogen spectrum disappeared, leaving only the argon and hydrogen lines. This behaviour of the spectrum tube makes the source of the argon uncertain, as it is in very small quantities. The conclusion is drawn provisionally that the argon is absorbed by the nitride. W. R.

Electrolytic Soda Industry. Theory of the Bell-chamber Process. ANDRÉ BROCHET (*Compt. rend.*, 1908, **147**, 674—676).—The salt solution undergoing electrolysis flows through the apparatus from cathode to anode. If the velocity of the liquid is equal or superior to that of the OH' ions, the yield should be theoretical. The velocity of the OH' ion varies directly as the ionic mobility and current density, and inversely as the conductivity. When the layer of liquid containing only OH anions remains stationary, the concentration of the caustic alkali leaving the apparatus varies directly as the conductivity and inversely as the ionic mobility, but is independent of current density and the nature of the cation. It follows that solutions of potassium chloride give a stronger alkali than common brine. Temperature has no influence on the strength of alkali obtained, but a high temperature economises current.

R. J. C.

Transparent Silver and other Metallic Films. THOMAS TURNER (*Proc. Roy. Soc.*, 1908, *A*, **81**, 301—310. Compare Beilby, Abstr., 1904, ii, 647).—The investigations of Faraday on the conditions of formation of transparent metallic films have been extended. Gold leaf does not undergo any change at 500°, but rapidly becomes transparent at 550°, microscopic examination showing that the originally translucent film has become aggregated to opaque masses, leaving clear spaces between them. Soft gold, which has not been mechanically strained, does not show this sudden change of properties.

Silver foil becomes slightly transparent in air at 240°, and more rapidly at higher temperatures. Heating to 500° in hydrogen or in charcoal powder does not produce transparency, whilst the effect on gold is independent of the surrounding gas. The presence of oxygen is necessary for the change in silver, although the quantity of oxygen absorbed is very minute. The particles of aggregated silver are smaller and less opaque than those of gold.

Copper undergoes a similar change, but much transparent oxide is formed. This is the origin of the coloured surface films obtained on oxidising copper. Aluminium and alloys of copper and zinc do not become transparent when heated. C. H. D.

The True Atomic Weight of Silver according to Stas's Experiments. Louis Dubreuil (*Compt. rend.*, 1908, **147**, 856—859).—It has been shown previously (this vol., ii, 936) that it is generally impossible to deduce the true value of an atomic weight from the measurement of a single analytical ratio, and that the method of least squares enables the most probable value for the atomic weights in question to be determined in each experiment. Comparison of the values so obtained for the same element gives the means of determining the true atomic weight, and the result is the more probable the greater the number of methods employed. The author has applied this method of calculation to the values obtained by Stas for the analytical ratios of AgCl, I, AgI, Ag_2S, KCl, NH_4Cl, NaCl, LiCl, KBr, NaBr, NH_4Br, $AgNO_3$, and Ag_2SO_4 compared with Ag, and for the ratios $KCl/AgNO_3$, $NH_4Cl/AgNO_3$, $AgCl/AgClO_3$, $AgBr/AgBrO_3$, and $AgI/AgIO_3$, and, as a general mean of them all, has obtained the value 107·9921 for the atomic weight of silver, the extreme values of the series being 108·0313, obtained from the ratio AgI/Ag, and 107·9449, for the ratio KBr/Ag.

Taking into consideration the fact that all the results employed are taken from the work of one experimenter, the conclusion is drawn that silver has the atomic weight 108. E. H.

Alloys of Silicon and Silver. G. Arrivaut (*Compt. rend.*, 1908, **147**, 859—861).—Wöhler (*Ann. Chim. Phys.*, 1858, [iii], **54**, 222), Warren (Abstr., 1889, 1125; 1893, ii, 474), and de Chalmot (Abstr., 1896, ii, 362) have obtained substances which they considered to be silver silicides, whereas Percy, Moissan (Abstr., 1896, ii, 173; 1904, ii, 560), and Vigouroux (Abstr., 1907, ii, 543) have repeatedly stated that silver and silicon do not combine. In view of this divergence of opinion, the author has examined mixtures of silver and silicon by Tammann's thermal method. The results are given in a table and in the form of curves.

Examination of the latter shows that the liquidus consists of two branches starting from the melting points of silver (950°) and silicon (1415°) respectively, and intersecting at about 800° in a point corresponding with about 5% of silicon. The solidus consists simply of a horizontal line passing through the eutectic point and extending from 0% to 90% of silicon; thus silver and silicon do not give any point of combination. Consideration of the periods of eutectic crystallisation suggests the existence of mixed crystals of silicon and silver, but this is not confirmed by analysis. In the fusions containing 40—60% of silicon, a small, white pearl is observed on the bluish-grey button of slightly oxidised silicon. This is formed probably owing to the increase in volume of the silicon on solidification. It contains 4·8% of silicon and 94·85% of silver. E. H.

Silver Sub-halides. A. P. H. Trivelli (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, 6, 358—372).—A critical comparison of the two chief theories regarding the nature of the silver sub-halides. It is shown that the phenomena, which are usually cited in support of the view that the sub-halide is an adsorption compound of colloidal silver and silver halide, can be explained equally satisfactorily in terms of the theory that the sub-halide is a molecular compound. In certain cases, the molecular theory accounts for the observed facts more satisfactorily than the adsorption theory.

In an appendix, it is pointed out that the reducing action of ammonium persulphate can be explained more simply in terms of the molecular theory than by the adsorption hypothesis. The denser portions of the developed image contain more silver and silver sub-halide and less silver halide than the less dense regions. A sodium thiosulphate solution will, in consequence, be more quickly saturated with silver thiosulphate in the less dense parts of the image. In the denser regions, the greater concentration of unchanged sodium thiosulphate will cause the sub-halide to be decomposed to a greater extent, and the resulting greater concentration of free silver is the cause of the more energetic action of the ammonium persulphate. H. M. D.

Reaction between Silver Sulphide and Silver Sulphate. Production of a Dark-coloured Glass. Otto Sackur (*Ber.*, 1908, 41, 3356—3359).—Experiments to determine the dissociation pressure of the system $Ag_2S + Ag_2SO_4 = 4Ag + 2SO_2$ were unsuccessful; as, although a constant pressure was obtainable after heating at a constant temperature (above 300°) for some days, repetition of the experiment gave different values. The pressure at 300° is above 10 atmospheres.

When heated in Thüringian glass, the mixture imparts to the glass surface, below 400°, after some time a reddish-brown colour, which absorbs the actinic rays of the spectrum. Such a glass contains several per cent. of silver. W. R.

Preparation and Composition of the Hydrogen Carbonates of Calcium and Barium. Edward H. Keiser and Sherman Leavitt (*J. Amer. Chem. Soc.*, 1908, 30, 1711—1714).—Experiments are described which show that calcium hydrogen carbonate is precipitated when potassium or ammonium hydrogen carbonate is added to a solution of calcium chloride at 0°, and that the salt can be separated and analysed if the temperature is not allowed to rise above 1° or 2°. Even at this temperature, the compound slowly decomposes. The results of analysis point to the formula $CaCO,1{\cdot}75H_2CO_3$.

Barium hydrogen carbonate can be obtained similarly by the action of ammonium hydrogen carbonate on barium chloride solution at 0°, but it undergoes gradual decomposition, and is therefore difficult to analyse. E. G.

Composition of the Hydrogen Carbonates of Calcium and Barium. EDWARD H. KEISER and LEROY MCMASTER (*J. Amer. Chem. Soc.*, 1908, **30**, 1714—1718).—Calcium and barium hydrogen carbonates were prepared in the manner described by Keiser and Leavitt (preceding abstract), except that precipitation was effected in a solution containing gelatin in order to retard decomposition. Analysis was effected by determining the ratio of carbon dioxide to calcium or barium oxide. The results show that the calcium salt has the composition $CaCO_3,1·8H_2CO_3$, and the barium salt the composition $BaCO_3,1·5H_2CO_3$. E. G.

Preparation of Calcium, Strontium, and Barium Silicides. TH. GOLDSCHMIDT (D.R.-P. 199193).—Calcium silicide may be produced by heating in an ordinary furnace a mixture of silicon and calcium oxide, the reaction being facilitated by the addition of some calcium fluoride and chloride. The interaction takes place as follows: $5CaO + 5Si = 2CaSi_2 + 3CaO,SiO_2$. A similar change occurs with the oxides of the other alkaline earths. G. T. M.

Zinc Phosphides. PIERRE JOLIBOIS (*Compt. rend.*, 1908, **147**, 801—803).—Zinc and phosphorus were heated together in a crucible until phosphorus vapour ceased to be evolved. The product was freed from excess of zinc either by ignition in a vacuum at 600° or by treatment with mercury or fuming nitric acid. The residual phosphide, Zn_3P_2, is identical with that described by Vigier (*Bull. Soc. chim.*, 1861, **3**, 5), and forms octahedral crystals, D^{13} 4·55, which dissolve readily in hydrochloric acid, giving pure phosphine.

The preparation of the phosphide, ZnP_2, from its elements is also described. This phosphide is non-crystalline, and has D^{15} 2·97; at 400°, it undergoes dissociation into phosphorus and Zn_3P_2.

W. O. W.

Sulphides of the Rare Earths. I. Cerium Sulphides and their Limits of Existence. WILHELM BILTZ (*Ber.*, 1908, **41**, 3341—3350. Compare Sterba, Abstr., 1904, ii, 662).—*Cerium disulphide*, Ce_2S_4, is prepared by heating cerium sulphide in a current of hydrogen sulphide at 580—600°, the experiment being controlled by weighing from time to time; 2 to 3 grams require twenty hours for complete conversion. It forms a dark yellowish-brown, crystalline powder, moderately stable in air and cold water. An oxygenated product, $Ce_2S_{2·5}O,S$, has also been obtained, and as this is of approximately the same weight as the disulphide, a complete analysis is necessary in characterising the compound. Hydrochloric acid (17·7%) dissolves the disulphide in the cold, an odour of hydrogen persulphide is noticed, and afterwards sulphur is precipitated. This is held to prove that the disulphide is not a true analogue of the dioxide, but a polysulphide, Ce_2S_3,S. The related *lanthanum disulphide*, La_2S_3,S, is dark yellow, and also gives hydrogen persulphide under similar conditions.

The red sesquisulphide, Ce_2S_3 (Muthmann and Stützel, Abstr., 1900, ii, 142), is obtained on heating the disulphide or the sulphate in a current of hydrogen sulphide at 750—800°.

The conversion of the disulphide into the sesquisulphide has been examined up to 1200°. The temperature of decomposition is about 720°; the lower sulphide is stable at a red heat, and does not react with hydrogen or nitrogen at that temperature, but between 1400° and 1500° it melts and decomposes. The sesquisulphide prepared at 745°; when heated in a current of hydrogen sulphide for thirty hours at 615°, did not re-absorb sulphur. This irreversibility is only apparent, as by heating the disulphide in a current of hydrogen at 400° the sesquisulphide was obtained, and this product re-absorbed 4·2% sulphur.

The heat of solution of the disulphide, CeS_2, in hydrochloric acid is 32,500 cal.; that of $CeS_{1\cdot5}$, 37,800 cal. (39,500 cal. from product prepared at 400°). From these figures, the equation $4CeS_2 = 2Ce_2S_3 + 2S(\text{amorp.}) - 18{,}600$ cal. is calculated.

By the use of Nernst's equation for heterogeneous equilibra, the decomposition temperature is calculated to be 793°, whereas that found was roughly 720°. W. R.

Eutectics. I. The Alloys of Lead and Tin. Walter Rosenhain with P. A. Tucker (*Phil. Trans.*, 1908, *A*, **209**, 89—122).—Alloys of pure lead and pure tin have been studied by thermal and microscopic methods, the curves of ordinary cooling and of differential cooling being taken. The eutectic point is at 62·93% of tin and 180°. Lead forms solid solutions with from 0 to 16% Sn at 180°. Former observers have found the presence of eutectic in alloys containing much less tin, and this is shown to be due to the slowness with which diffusion takes place in the solid alloys. Heating at 175° for six weeks was found to be necessary to bring about equilibrium. On the other hand, tin does not form solid solutions with small quantities of lead.

Alloys containing from 18 to 63% of tin undergo a change, accompanied by development of heat, on cooling to 149°. In alloys containing from 8 to 18% Sn, the transformation takes place at lower temperatures, the passage of the solid solution from the β- to the α-form involving the rejection of a part of the tin. The alloy with 8% Sn appears to remain in the β-form down to the temperature of liquid air. The lead constituent of the eutectic, however, appears to remain in the metastable β-form. The density of the alloys confirms the view that the lead constituent of the eutectic differs from the stable α-solid solution.

A microscopic study of the eutectic alloy shows that it is composed of grains, within each of which the crystallites have a definite orientation. Each grain is to be regarded as a spherulitic crystal of the β-solution, the tin forming a matrix or filling.

The paper is illustrated with photo-micrographs. C. H. D.

Electrolytic Corrosion of Brasses in Synthetic Sea-Water. Azariah T. Lincoln and G. C. Bartells, jun. (*J. Physical Chem.*, 1908, **12**, 550—556. Compare Lincoln, Klein, and Howe, Abstr., 1907, ii, 953).—The corrosion of fully annealed copper-zinc alloys was measured, using an artificial sea-water prepared by dissolving salts. The corrosion curves are similar to those obtained in solutions of sodium chloride. With the appearance of the γ-phase, copper ceases to appear in the corrosion product. C. H. D.

Recalculation of the Vapour Pressure of Mercury. T. H. Laby (*Phil. Mag.*, 1908,, [vi], **16**, 789—796).—The recorded observations of the vapour pressure of mercury have been compared, and the more concordant values have been combined with the object of obtaining a table of most probable values. Two Kirchhoff formulæ are given which satisfactorily express the recorded observations. The vapour-pressure values (in terms of mm. of mercury at 0°) are recorded for every 5° between 15° and 365°, and also for 370°, 380°, 390°, 400°, and 450°. It is also shown that the experimental data of Cailletet, Colardeau, and Rivière for temperatures up to 700° can be satisfactorily expressed by means of a Kirchhoff formula.

H. M. D.

Constitution of Certain Mercuric Compounds with Complex Cations. II. Vincenzo Borelli (*Gazzetta*, 1908, **38**, ii, 421—474. Compare this vol., i, 515).—According to Abegg and Bodländer's principle of electro-affinity (Abstr., 1899, ii, 542), the tendency of the mercuric halogen salts to form complex cations is weaker the stronger the anion combining with the mercuric ion to form the cation, since increase of the electro-affinity of the halogen radicle should be accompanied by an increase in the tendency of the radicle to dissociate according to the scheme: $HgX^{\cdot} \longrightarrow Hg^{\cdot\cdot} + X'$. This is actually found to be the case, the tendency to form these complex ions being greatest with mercuric iodide and cyanide, less marked with the bromide, and so slight with the chloride that the corresponding double salt cannot be isolated. The author has studied the complex salts formed by mercuric iodide, bromide, chloride, and thiocyanate with mercuric perchlorate, the results obtained being parallel with those observed in the case of the similar complex salts yielded by mercuric cyanide. The behaviour of insoluble mercuric compounds of the type HgX'' toward mercuric salts with strong anions is quite analogous to that of the insoluble salts of the type HgX'_2.

Iodomercury perchlorate, $HgI{\cdot}ClO_4$, forms bundles or mammillary masses of white, opaque prisms, which deliquesce and turn yellow in the air, and are decomposed by water with liberation of mercuric iodide. Cryoscopic measurements in water give values for the molecular weight lower than that calculated for complete dissociation of the compound into its components and allowing for the partial hydrolysis of the mercuric perchlorate according to the equation: $Hg(ClO_4)_2 + H_2O = Hg(OH){\cdot}ClO_4 + HClO_4$ (compare Heimbucher, *Diss.*, Würzburg, 1904; Abstr., 1904, ii, 465). The depression of the freezing point of water by mercuric perchlorate is diminished by mercuric iodide, the diminution increasing with the proportion of iodide present in the solution; the complex molecular concentration hence undergoes a corresponding diminution. Similar behaviour is observed when mercuric cyanide is dissolved in an excess of a concentrated solution of mercuric perchlorate. The conductivity of mercuric perchlorate solution is also diminished by the presence in the solution of mercuric iodide, owing to diminution of the ionic concentration and to the lower mobility of the new ions formed. The addition of mercuric iodide or cyanide produces an increase in the molecular concentration of mercuric perchlorate solution when this is not excessively concentrated, and a diminution when an excess of the perchlorate is present. These results are regarded as due to various reactions between the mercuric iodide and the ions, $Hg^{\cdot\cdot}$ and ClO_4', originally present in the solution. The analogy between these results and those obtained with mercuric cyanide indicates that the mercuric iodide unites with the $Hg^{\cdot\cdot}$ ions to give complex cations; this view is supported by transport measurements of solutions of mercuric iodide containing excess of the perchlorate.

Bromomercury perchlorate, $HgBr\cdot ClO_4$, forms bundles or mammillary masses of short, white prisms. When mercuric bromide is dissolved in a solution of mercuric perchlorate, it causes depression of the freezing point and regular elevations of the boiling point, and, consequently, an increase in the concentration. Into these solutions, mercuric bromide enters under the form of the ions $HgBr^{\cdot}$, and also, to a slight extent, of the ions $Hg_2Br_2^{\cdot\cdot}$. The existence of these conplex ions is shown by measurements of the variation of the concentration of mercuric bromide at the electrodes during electrolysis.

Chloromercury perchlorate could not be isolated. The presence of 1 mol. of mercuric chloride per mol. of the perchlorate in solution produces an increase of 0·028% in the original conductivity, but the addition of a further 1·5 mols. of the chloride causes no further increase. The conductivity curve shows that mercuric chloride exhibits a tendency to form the ions $HgCl^{\cdot}$ about 500 times less than the tendency of the cyanide to form the ions $HgCN^{\cdot}$.

The author has not succeeded in isolating chloromercury nitrate, $HgCl\cdot NO_3$ (compare Morse, Abstr., 1903, ii, 12), but conductivity measurements demonstrate the undoubted presence of the ions $HgCl^{\cdot}$ and NO_3' in solutions containing mercuric chloride and nitrate.

Thiocyanomercury perchlorate, $Hg(CNS)\cdot ClO_4$, was obtained as a white, crystalline crust. The addition of mercuric thiocyanate to a solution of mercuric perchlorate produces a diminution in the molecular concentration.

The author has been unable to prepare the compound,

$$2Hg(ClO_4)_2,HgO,12H_2O,$$

described by Chikashigé (Trans., 1905, 87, 822), the products obtained being basic compounds containing approximately $2Hg(ClO_4)_2$ per 3HgO. When mercuric oxide is dissolved in a solution of mercuric perchlorate, it produces diminution of the molecular concentration; the diminution produced increases with the concentration of the perchlorate solution, as, therefore, does the complexity of the compounds formed. T. H. P.

Precipitation of Gelatinous Mixtures of Alumina and Silica, and their Relation to Allophane, Halloysite, and Montmorillonite. H. STREMME (*Centr. Min.*, 1908, 622—632, 661—669).—The gelatinous precipitates obtained from solutions of sodium silicate and aluminium acetate are of very variable composition, depending on the strength of the solutions and on their acidity. In an acid solution there is at first only a turbidity, and the gelatinous precipitate afterwards deposited is richer in silica than that from a neutral solution.

Carbonic acid and acetic acid dissolve the alumina more readily than the silica from the precipitates. The conclusion is drawn that these precipitates do not represent any definite hydrated aluminium silicate, but that they are simply mixtures of gelatinous aluminium hydroxide and hydrated silica. The same relations also exist in the various amorphous minerals of the clay group. The published analyses of these are tabulated, and they show wide variations in composition: for minerals of the allophane group, the ratio $Al_2O_3:SiO_2$ varies from 1 : 0·31 to 1 : 1·91; for the halloysite group, 1 : 1·68 to 1 : 3·89; and for the montmorillonite group, 1 : 2·51 to 1 : 5·32. The conclusion is therefore drawn that these are not definite mineral species, but mixtures in variable proportions of colloidal aluminium hydroxide and hydrated silica. L. J. S.

Ferromagnetic Nitrogen Compounds of Manganese. EDGAR WEDEKIND and THEO. VEIT (*Ber.*, 1908, **41**, 3769—3773. Compare Abstr., 1907, ii, 353; Shukoff, this vol., ii, 484).—With the object of ascertaining whether elements which are gases at the ordinary temperature form ferromagnetic derivatives with manganese, the nitrides of manganese have been investigated. Trimanganese nitride, Mn_3N_2 (compare Prelinger, Abstr., 1894, ii, 16), has only feeble magnetic properties, whilst pentamanganese nitride, Mn_5N_2, is slightly more magnetic. The *nitride*, Mn_7N_2, obtained by the action of ammonia on manganese heated with an oxy-hydrogen blowpipe, has stronger magnetic properties than either of the above nitrides, and is almost as magnetic as manganese boride; it is readily attacked by acids and alkalis.

Chromium nitride, CrN, has only feeble magnetic properties. W. H. G.

The System Iron–Phosphorus. E. GERCKE (*Metallurgie*, 1908, **5**, 604—609).—Alloys rich in phosphorus were prepared by adding red phosphorus to molten iron in a magnesite crucible. The product containing 17·3% P was re-melted with different proportions of iron. The eutectic temperature is 980°; mixtures low in phosphorus show considerable undercooling. Iron retains up to 1·70% of phosphorus in solid solution, beyond this the eutectic, containing 10·2% P, is present as a constituent. The solid solution undergoes a change of structure, which has not been fully investigated, at 600°.

C. H. D.

The Ternary System Iron-Phosphorus-Carbon. PAUL GOERENS and W. DOBBELSTEIN (*Metallurgie*, 1908, **5**, 561—566. Compare Wüst, this vol., ii, 287).—The ternary eutectic point of the system is found to lie at 1·96% C, 6·89% P, and 91·15% Fe, and at 953°. The position of the three binary eutectic curves in the system iron–iron carbide–iron phosphide has also been determined. Both thermal and microscopic methods have been employed.

The microscopic sections are best prepared by etching and heat-tinting, subsequently re-polishing lightly. The oxide film is much more readily removed from cementite than from the phosphide, thus allowing the two to be distinguished. C. H. D.

The Iron-Carbon Equilibrium. GEORGE B. UPTON (*J. Physical Chem.*, 1908, **12**, 507—549).—The results of other observers are examined and recalculated, the silicon and other elements present in the samples examined being calculated as "equivalent carbon." The author concludes that cementite must find a place in the diagram of stable equilibrium, and he assumes the formation of three carbides in all, Fe_6C, Fe_3C, and Fe_2C, of which the first is stable only above 800° and the second above 600°. The brittleness of steel at 500—550° is considered to be due to the change from Fe_3C to Fe_2C. An equilibrium diagram has been constructed on these assumptions.

C. H. D.

Hydrolysis of Ferric Chloride; Influence of Neutral Salts. G. MALFITANO and LEOPOLD MICHEL (*Compt. rend.*, 1908, **147**, 803—806. Compare Abstr., 1907, ii, 692; this vol., ii, 111, 288).—The phenomena of the colloidal state are more pronounced and appear more rapidly in solutions of ferric chloride to which potassium chloride has been added than in solutions of ferric chloride alone. The authors have measured the increase in electrical conductivity of solutions of ferric chloride, alone and with varying amounts of potassium chloride, produced by raising the temperature from 18° to 100° for fifteen minutes, and after allowing the solutions to remain for sixteen and twenty-four hours respectively. The results lead to the conclusion that the rate of hydrolysis of the ferric chloride depends on the proportion of potassium chloride present, and that the size of the micro-cells of ferric hydroxide is increased by the addition of this salt. The number of ferric ions being diminished, there are fewer centres of attraction for the ferric hydroxide molecules, and consequently the individual cells are more voluminous.

The chlorides of sodium, ammonium, barium, and magnesium, and also potassium nitrate, behave in a similar manner. Mercuric chloride, on the other hand, being a non-electrolyte, has no appreciable influence on the course of the hydrclysis. Salts containing multivalent negative ions, such as potassium sulphate, behave like the multivalent acids previously studied in hindering hydrolysis. W. O. W.

Molybdates of Nickel and Cobalt. M. EMMANUEL POZZI-ESCOT (*Bull. Soc. chim.*, 1908, [iv], **3**, 1012).—The author has been informed by Marckwald that the attribution to the latter by Grossmann and

Schück (this vol., ii, 230) of certain work on nickel and cobalt molybdates is inaccurate. T. A. H.

Antimony Trichloride as Ionising Solvent. Z. KLEMENSIEWICZ (*Bull. Acad. Sci. Cracow*, 1908, 485—494).—The measurements were made by the electrical conductivity method with platinised electrodes in the usual way. The carefully-purified solvent has D^{75} 2·681 and D^{97} 2·647; the smallest conductivity observed amounted to $8·5 \times 10^{-7}$ reciprocal ohms.

As solutes, the chlorides of potassium, rubidium, ammonium, and thallium were used, and measurements were made up to a dilution of 1024 litres and at different temperatures. The conductivities in dilute solutions are greater, in concentrated solutions (above $N/10$) less, than for the corresponding aqueous solutions. It is probable that the degree of ionisation is less for solutions in antimony chloride than in water, but that the ionic velocity is greater in the former case. The conductivity of the solutions increases regularly with the temperature from 70° to 150—200°.

The viscosity of antimony trichloride has been measured from 80° to 200°. The curve obtained by plotting the fluidity (reciprocal of the viscosity) against the temperature appears to show a change of direction at 120°, but a high degree of accuracy is not claimed for the results. G. S.

Melting-point Curves for the Systems Bismuth + Chlorine and Bismuth + Bromine. B. G. EGGINK (*Zeitsch. physikal. Chem.*, 1908, **64**, 449—505).—After reviewing the various compounds of bismuth with chlorine and bromine which have been described, the author proceeds to a theoretical discussion of the possible liquid-solid equilibria in a system of two components in which two liquid phases may occur. In this discussion, the author uses the graphical method introduced by van Ryn van Alkemade (Abstr., 1893, ii, 363).

The experimental study of the systems bismuth + chlorine and bismuth + bromine has shown that compounds of the formulæ BiCl and BiBr exist, which, on melting at 320° and 287° respectively, both form two liquid phases. Further, an endothermic compound $BiCl_4$ exists, which is only slightly dissociated in the fused condition. So far as the evidence of the freezing-point curve goes, there are no compounds of the formulæ $BiCl_2$, $BiBr_2$, and Bi_3Cl_8; the author's results are therefore not in harmony with those of Herz and Guthmann (this vol., ii, 199). J. C. P.

Columbium. CLARENCE W. BALKE and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1908, **30**, 1637—1668).—A continuation of the investigation of the compounds of columbium and tantalum (Abstr., 1905, ii, 828, 829). The conclusion is confirmed that the coloration produced on the addition of hydrogen peroxide to a solution of columbium in hydrofluoric acid is not due to the presence of titanium, but is probably due to columbium itself. A large quantity of potassium columbium fluoride, K_2CbF_7, was prepared and carefully purified, and was afterwards converted into the oxide, which had D 4·8. This oxide still gave the reaction with hydrogen peroxide, and, in order to study further the question as to whether the reaction might not be due to the presence of some other element, the oxide was converted into the chloride, and the latter fractionally distilled. The whole of the product distilled at about 241°, and no differences could be detected between the fractions obtained. On a spectroscopic examination of the oxide prepared from the chloride, neither tantalum nor titanium lines were observed. Vapour density determinations of the chloride by Dumas' method gave a mean value of 9·45, as compared with the calculated value 9·35 [$Cb = 93·5$]. Specimens of the oxide prepared from the chloride had D varying from 4·48 to 5·02. The chloride had D 2·73—2·77. A careful determination of the atomic weight of columbium based on the ratio between the chloride and oxide gave as mean of eight determinations the value 93·50 [$O = 16$; $Cl = 34·45$].

A résumé is given of the various columbates described in the literature. Sodium columbate, $Na_2O,Cb_2O_5,7H_2O$, crystallises in triclinic prisms [$a:b:c = 0·9559:1:0·8394$; $\alpha = 71°20'$; $\beta = 105°30'$; $\gamma = 54°7'$]. *Magnesium columbate*, $MgO,Cb_2O_5,7H_2O$, the *silver* salt, $Ag_2O,Cb_2O_5,2H_2O$, the *copper* salt, $CuO,Cb_2O_5,3\frac{1}{2}H_2O$, the *aluminium* salt, $Al_2O_3,3Cb_2O_5,12H_2O$, and the *cadmium* salt, $CdO,Cb_2O_5,3\frac{1}{2}H_2O$, are described. The *potassium* salt, $4K_2O,3Cb_2O_5,16H_2O$, forms monoclinic crystals [$a:b:c = 0·7120:1:0·5547$; $\beta = 84°19'$]. The *rubidium* salt, $4Rb_2O,3Cb_2O_5,14H_2O$, is isomorphous with the salts $4Rb_2O,3Ta_2O_5,14H_2O$, $4Cs_2O,3Cb_2O_5,14H_2O$, and $4Cs_2O,3Ta_2O_5,14H_2O$, and crystallises in monoclinic prisms [$a:b:c = 0·8815:1:1·4091$; $\beta = 84°7'$]. The following *columbates* are also described: $7K_2O,6Cb_2O_5,27H_2O$, $7Li_2O,6Cb_2O_5,26H_2O$, $7Cs_2O,6Cb_2O_5,30H_2O$, and $3Rb_2O,4Cb_2O_5,9\frac{1}{2}H_2O$.

The following *percolumbates* have been obtained: Na_3CbO_8, K_3CbO_8, Rb_3CbO_8, Cs_3CbO_8, $MgNaCbO_8,8H_2O$, $MgKCbO_8,7H_2O$, $MgRbCbO_8,7\frac{1}{2}H_2O$, $MgCsCbO_8,8H_2O$, $CaNaCbO_8,4H_2O$, and $CaKCbO_8,4H_2O$.

The *sodium columbium fluorides*, $3NaF,CbOF_3$ and $3NaF,CbO_2F_3,H_2O$, have been prepared, but the salts, $2NaF,CbOF_3,2H_2O$ and $NaF,CbOF_3,H_2O$, described by Marignac could not be obtained. The existence of the potassium salts, $2KF,CbOF_3,H_2O$, $3KF,CbOF_3$, $3KF,HF,CbOF_3$, $5KF,3CbOF_3,H_2O$, $4KF,3CbOF_3,2H_2O$, and $2KF,CbF_5$, described by Marignac, was confirmed. The salt $3KF,HF,CbOF_3$ forms monoclinic needles [$a:b:c = 0·6304:1:0·4888$; $\beta = 86°41'$]. The double fluoride, $2RbF,CbF_3$, described by Pennington (Abstr., 1896, ii, 305) could not be obtained, but the following *salts* were prepared: $2RbF,CbOF_3$, RbF,CbF_5, and $2RbF,CbO_2F_3,H_2O$. The *rubidium tantalum* salt, $2RbF,TaO_2F_3,H_2O$, forms thin, white leaflets. The *caesium* salts, $2CsF,CbOF_3$ and CsF,CbF_3, are described. The *thallium* salt, $2TlF,CbOF_3$, forms orthorhombic crystals [$a:b:c = 0·4261:1:1·0129$].

A study has been made of the double tantalates. The *salt*

$$4Rb_2O,3Ta_2O_5,14H_2O$$

forms monoclinic crystals [$a:b:c = 0{\cdot}8822:1:1{\cdot}0510$; $\beta = 84°2'$]. The *salts* $4Cs_2O,3Ta_2O_5,14H_2O$ and $7Cs_2O,6Ta_2O_5,38H_2O$ are also described.

The following *pertantalates* have been prepared: Rb_3TaO_8, Cs_3TaO_8, $MgNaTaO_8,8H_2O$, $MgKTaO_8,7H_2O$, $MgRbTaO_8,9H_2O$, and

$$CsNaTaO_8,4\tfrac{1}{2}H_2O.$$

E. G.

Spectrum and the Bromides of Columbium. WILLIAM M. BARR (*J. Amer. Chem. Soc.*, 1908, **30**, 1668—1672).—It has been shown by Hall and Smith (Abstr., 1905, ii, 829) that the hydrogen peroxide test for titanium in a solution of columbium in hydrofluoric acid is not trustworthy. For this reason, spectroscopic examination has been resorted to. Hildebrand (following abstract) has submitted carefully-purified columbium oxide prepared by Balke and Smith (preceding abstract) to a spectroscopic examination, and has found that, whilst nearly all the titanium lines were absent from the spectrum, certain lines were present which are common to both metals. A study has therefore been made of the spectra of specimens of columbium oxide prepared from minerals of different character and from different localities, and purified by Balke and Smith's methods. The results indicate that these methods of purification are efficient, that the spectra of columbium from all sources are identical, and that the lines common to both the columbium and titanium spectra are not due to the presence of titanium in the columbium, and probably not to any other element, but are merely coincident lines.

The "Niobunterbromid" described by Rose (*Ann. Phys. Chem.*, 1858, **104**, 441) has been studied, and found to be columbium oxybromide, $CbOBr_3$. The dark red compound formed simultaneously is the pentabromide, $CbBr_5$, as stated by Rose. Both these salts are described.

A *columbium iodide* has been prepared from the bromide, and is being investigated. E. G.

Arc Spectrum of Columbium. JOEL H. HILDEBRAND (*J. Amer. Chem. Soc.*, 1908, **30**, 1672—1684. Compare Balke and Smith, and Barr, preceding abstracts).—The arc spectrum of columbium has been measured between λ2600 and λ6000, using specimens of the oxide obtained from euxenite, tantalite, columbite, and aeschynite. The results are tabulated.

It has been found that Balke and Smith's method for preparing columbium oxide, free from titanium, is satisfactory, and that the existence of any element common to columbium and titanium is very improbable. The identity of the spectra of columbium from different sources affords strong evidence of its elementary character.

E. G.

Metallographic and Metallurgical Notes. [Thermal Diagrams. Microscopy of Alloys.] K. FRIEDRICH (*Metallurgie*, 1908, **5**, 593—604).—I. It was found impossible to obtain thermal diagrams of the systems platinum–sulphur, gold–selenium, gold–sulphur, gold–arsenic, or zinc–sulphur on account of the volatility of one component. The existence of the sulphide, Zn_2S, is improbable.

II. The use of ultra-violet light in the microscopic study of alloys is not found to have any advantages. C. H. D.

Atomic Weight of Palladium. GEORGE I. KEMMERER (*J. Amer. Chem. Soc.*, 1908, **30**, 1701—1705).—The results of previous work on the atomic weight of palladium show considerable variation, and, for this reason, the present investigation was undertaken. The experiments were carried out with (*A*) palladiodiammonium chloride purified by Keller and Smith's method (Abstr., 1893, ii, 73); (*B*) the same salt purified by means of ammonium cyanide instead of the mercuric cyanide used by Keller and Smith, and ammonium salts instead of sodium or potassium salts, and (*C*) palladiodiammonium cyanide, $Pd(NH_3CN)_2$. In each case a porcelain boat containing the salt was enclosed in a tube heated by an electric heater, and was reduced to the metal by means of carefully-purified electrolytic hydrogen. The following results were obtained: salt *A*, mean of five experiments, 106·399; salt *B*, mean of four experiments, 106·442; salt *C*, mean of six experiments, 106·458. The mean value of all the determinations gave an atomic weight, 106·434 [Cl = 35·473; H = 1·008; N = 14·01]. E. G.

Mineralogical Chemistry.

Natural Zirconium Oxide Free from Iron. EDGAR WEDEKIND (*Zeitsch. angew. Chem.*, 1908, **21**, 2270—2271).—Of the three forms in which Brazilian zirconium ore occurs, that containing the greatest amount of zirconium is the black, glassy, lump variety; analysis gave:

ZrO_2.	TiO_2.	Fe_2O_3.	SiO_2.	$ZrSiO_4$.	Total.
94·12	0·98	3·22	0·43	1·98	100·73

When examined under the microscope, this mineral was found to be composed of black particles embedded in a brownish-yellow, powdery substance. When separated mechanically, the black portion was found to be quite free from iron; analysis gave:

ZrO_2.	SiO_2.	TiO_2.	Insol.	Total.
97·97	1·72	1·20	0·10	100·99

From this it is evident that the colour previously ascribed to the presence of iron must be caused by the titanium, as, indeed, must be the colour of many other stones and minerals. Crystalline, natural zirconium oxide is feebly radioactive; it has D 5·41, a value somewhat higher than that, D 5·1, of the artificial, crystalline substance. J. V. E.

Kröhnkite, Natrochalcite (a New Mineral), and Other Sulphates from Chile. CHARLES PALACHE and CHARLES H. WARREN (*Amer. J. Sci.*, 1908, [iv], **26**, 342—348 *).—The specimens described are from copper veins in the mining district of Chuquicamata, in the province of Antofagasta, and include kröhnkite, natrochalcite, blödite, brochantite, atacamite, chalcanthite, copiapite, botryogen, sideronatrite, halite, and gypsum.

Kröhnkite.—The large, well-developed crystals are monoclinic, with $a : b : c = 0·5229 : 1 : 0·4357$; $\beta = 56°17\frac{1}{3}'$; they are twinned on (001), and have a perfect cleavage parallel to (010) ; hardness $2\frac{1}{2}$. Three types of specimens are distinguished : (i) clusters of octahedroid crystals of a dull greenish-blue colour ; (ii) single prismatic crystals and fibrous or acicular aggregates of a pale blue colour ; (iii) solid crusts of large, prismatic crystals of a deep vitriol-blue colour. Analysis I gives the usual formula : $CuSO_4,Na_2SO_4,2H_2O$. The water is mainly given off below 150°, but small amounts continue to come off up to 350°. The mineral is fusible without decomposition to a bright green enamel.

Natrochalcite.—This new species occurs as bright emerald-green, monoclinic crystals with an acute pyramidal habit [$a : b : c = 1·423 : 1 : 1·214$; $\beta = 61°17\frac{1}{2}'$]. Cleavage (001) perfect ; hardness $4\frac{1}{2}$. Complete optical determinations are given for this, as also for kröhnkite. Analysis II agrees with $Na_2SO_4,Cu_4(OH)_2(SO_4)_2,2H_2O$. The water is given off gradually above 150°, and between 350° and a low red-heat, sulphuric anhydride is expelled. The mineral readily fuses to a black bead.

Blödite.—Analysis III, of massive, granular material, agrees with the usual formula : $MgSO_4,Na_2SO_4,4H_2O$.

	CuO.	MgO.	Na_2O.	SO_3.	H_2O.	Insol.	Cl.*	Total.	Sp. gr.
I.	23·25	—	18·89	47·60	10·72	—	trace	100·46	2·061
II.	41·95	—	8·44	42·10	7·70	0·70	0·05	100·94	2·33
III.	—	12·00	18·20	47·49	21·60	0·50	—	99·70	—

* Cl from atacamite.

L. J. S.

Analyses of Gabbronitic Rocks from Neurode, Silesia. FELIX TANNHÄUSER (*Sitzungsber. k. Akad. Wiss. Berlin*, 1908, 1069—1075).—Nine analyses are given of gabbro, anorthosite, pyroxenite, olivine-gabbro, troctolite, serpentine, diabase, gabbro-aplite, and spessartite. L. J. S.

Physiological Chemistry.

Heats of Solution of Gases in Blood. MARIO CAMIS (*Mem. Real. Accad. Sci. Torino*, 1908, [ii], **58**, 141—169).—The author has measured calorimetrically the heat changes occurring when oxygen and carbon dioxide pass into, or out of, solution in blood. The absorption of 1 gram-mol. of carbon dioxide by the blood is accompanied by the evolution of 5·40 Cal., the corresponding value for oxygen being

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* and *Zeitsch. Kryst. Min.*, 1908, **45**, 529—538.

10·22 Cal. Taking mean numbers for the daily respiratory exchange, it is calculated that, for a man weighing 70 kilos., this exchange leads to the production of about 127 Cal. per day. The blood pigment and the oxygen absorbed probably react endothermically. The paper concludes with a bibliography. T. H. P.

Estimation of the Respiratory Capacity of Small Quantities of Blood. HEINRICH DRESER (*Arch. exp. Path. Pharm., Suppl.*, 1908, 138—149).—Certain modifications of Haldane's carbon monoxide method, and of Barcroft's gas analysis methods, are proposed. In investigating the effect of certain antipyretics on the respiratory capacity, it was found that many of these produce methæmoglobin formation, and the oxygen so combined is not displaced by carbon monoxide. A comparison of *m*-tolylhydrazine, β-acetylphenylhydrazine (pyrodine), and the semicarbazide of *m*-tolylhydrazine shows that the semicarbazide substitution is much less harmful than the acetyl substitution, as in acetanilide and phenacetin. W. D. H.

Glycine in Normal Blood. ADOLF BINGEL (*Zeitsch. physiol. Chem.*, 1908, **57**, 382—388).—By the use of the Fischer-Bergell naphthalenesulphonyl chloride method, it is possible to demonstrate the existence of glycine in normal ox-blood. From 10 litres, 0·2 gram of the glycine compound was obtained. A higher amino-acid, or a peptide-like substance, is also present. W. D. H.

Reaction of the Blood after Intravenous Injection of Acid and Alkali. N. VAN WESTENRYK (*Arch. exp. Path. Pharm., Suppl.*, 1908, 517—527).—That the titration method shows the blood to be alkaline is due to the fact that the acid used may displace a weaker acid in neutral salts. Many indicators are not indifferent chemical substances, but may be themselves acid or basic. By the use of neutral-red and other indicators, the reaction of the blood is shown to be neutral, and remains neutral under various pathological conditions. It alters in experimental acid or alkali poisoning. Alkali poisoning produces stimulation, increasing the action of the heart and kidneys; acid produces the opposite effects. In acid poisoning, the organism remains neutral, as the acid is fixed and neutralised in the muscular tissues. Previous observations that the alkalinity of the blood decreases on destruction of the red corpuscles, are confirmed by the new methods. W. D. H.

Spectrophotographic Investigations on the Action of Hydrocyanic Acid on Blood. LOUIS LEWIN (*Arch. exp. Path. Pharm., Suppl.*, 1908, 337—348).—Details are given of the spectroscopic appearances of blood and hæmoglobin treated with hydrocyanic acid. Cyanomethæmoglobin and cyanohæmatin do not appear to exist; the spectroscopic appearances of their so-called compounds are identical with those of cyanohæmoglobin. Blood so treated catalyses hydrogen peroxide quite typically. The cause of the toxic action of hydrocyanic acid is discussed, and the conclusion is drawn that it is not a blood poison in the biological sense. W. D. H.

Action of Oxidising Salts. Arthur R. Cushny (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 126—137).—The relative activity of oxidising salts on the blood and tissues runs fairly parallel to their oxidising power on simpler chemical compounds. But in many cases other factors step in. The blood corpuscles and pigment react more readily to weak oxidising agents than do muscle or epithelium. In certain cases, also, substances which oxidise blood corpuscles and pigment readily are feeble oxidising agents for simpler chemical substances; the reverse is also seen. W. D. H.

Hæmolytic Action of Mercury Salts. J. Dunin-Borkowski (*Bull. Acad. Sci. Cracow*, 1908, 494—505).—The hæmolytic action of mercury salts on the serum-free blood corpuscles (erythrocytes) of different animals has been investigated. With mercuric chloride, the resistance to hæmolysis increases in the order: guinea-pig, sheep, cow, pig, calf, dog. A higher concentration of mercuric chloride than that required to produce complete hæmolysis, agglutinates the erythrocytes.

Mercuric iodide has considerable hæmolytic activity, and mercuric cyanide, although not ionised, is almost as active as the chloride. Potassium cyanide is less active than mercuric cyanide. It follows that hæmolysis does not depend on the concentration of Hg'' ions alone, although the ionic concentration probably has some effect, as sodium chloride lessens the activity of mercuric chloride.

The rate of hæmolysis with different concentrations of mercuric chloride has also been measured. With small concentrations, the constants calculated for a unimolecular reaction diminish, and with fairly high concentrations they increase considerably during the reaction, being approximately constant for intermediate concentrations.

The temperature-coefficient for 10° between 18° and 25° is 4·37 for erythrocytes from the guinea-pig, and 2·6 between 18° and 32° for those from the dog. The coefficient is much greater at higher temperatures, owing to the fact that hæmolysis is produced to some extent by heat alone, and, further, the erythrocytes which have been heated alone for some time are much more readily acted on by mercuric chloride than those which have not been heated. G. S.

Peptolytic Ferments in the Stomach Contents. Emil Abderhalden and Florentin Medigreceanu (*Zeitsch. physiol. Chem.*, 1908, 57, 317—324).—The observations were made on a dog with a gastric fistula, and confirm those made by Boldyreff, that, after a meal rich in fat, the contents of the duodenum regurgitate into the stomach. Under these conditions, the stomach contents contain a peptolytic ferment, and when neutralised, resolve glycyl-*l*-tyrosine into its constituent amino-acids. Under ordinary conditions, however, the ferment is rendered rapidly inactive by the acid of the gastric juice. W. D. H.

Influence of the Products of Reaction on the Hydrolysis of Fats by Pancreatic Juice. Mlle. L. Kalaboukoff and Émile Terroine (*Compt. rend.*, 1908, **147**, 712—715).—Both fatty acids and their sodium salts diminish the rate of hydrolysis; glycerol, on the other hand, has a considerable accelerating action. This acceleration does not take place when a soluble ester, such as monobutyrin, or natural emulsions, such as egg-yolk or cream, or solid fats, such as lard, are submitted to the action of the juice. The action of the glycerol is to be ascribed to the fact that a better distribution of the lipase between the aqueous and oily phases takes place in its presence; other syrupy substances can produce a similar acceleration. S. B. S.

Digestion in Animals. XXVII. Relationship of Concentration to Absorption in the Intestine. E. S. London and W. W. Polowzowa (*Zeitsch. physiol. Chem.*, 1908, **57**, 529—546. Compare this vol., ii, 960).—Details are given of the relative amount of absorption in the intestine of the water and sugar contained in solutions of dextrose of different concentrations. W. D. H.

Absorption of Fat from Intestinal Loops in Dogs. O. H. Plant (*Amer. J. Physiol.*, 1908, **23**, 65—80).—Bile salts increase the absorption of fats from a mixture which contains free fatty acid or soap; they only slightly increase the absorption of neutral oil. Solutions of soap, or biliary solutions of fatty acids, are absorbed more rapidly than emulsified fats. If both bile and pancreatic juice are excluded from the intestinal loop, neutral oil is nevertheless absorbed, and it becomes markedly acid in reaction. Taken as a whole, the experiments favour the view that fats are absorbed in solution rather than as an emulsion. W. D. H.

Absorption of Iodised Proteins. Otto von Fürth and M. Friedmann (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 214—223).—An iodised protein (iodalbacid) is before absorption in the cat's intestine broken down in large measure so completely that the iodine in the intestinal wall and blood is not in combination as proteose or peptone, but only as alkali iodides. W. D. H.

Action of Intestinal Astringents on Metabolism. Karl Spiro (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 504—512).—Opium, bismuth subnitrate, and tannigen produce but little change in nitrogenous metabolism in dogs. With opium the C : N ratio in the urine goes up, this is due to a fall in the nitrogen; the nitrogen in the fæces is but little altered. Tannigen, on the other hand, causes a loss of urinary, and an increase of fæcal nitrogen, the total excretion of nitrogen being about the normal; a sinking of the C : N ratio in the urine is mainly due to a relative decrease in the excretion of carbon. W. D. H.

Creatinine Metabolism. G. Lefmann (*Zeitsch. physiol. Chem.*, 1908, **57**, 476—514).—The excretion of creatinine and creatine is pretty constant in well nourished animals. If either substance is added to the food, it is excreted unchanged. If creatine is given by the mouth or parenterally, it is never changed into creatinine; in inanition it is almost completely excreted as such. Disease of the liver or increased protein catabolism produce first an increase, then a decrease, in creatinine excretion, and when it is lessened, the amount of creatine excreted increases. The liver is the probable seat of creatinine formation. If nephritis is induced by chromates, nearly all the creatinine is changed into creatine, probably by the alteration in the reaction of the urine. W. D. H.

The Changes in Gaseous Metabolism after Exclusion of the Hepatic Circulation. VITTORIO SCAFFIDI (*Biochem. Zeitsch.*, 1908, **14**, 156—179).—Experiments were carried out on ducks, the liver circulation being excluded by ligaturing the portal vein. As birds were employed for the experiments, it was not necessary to make an Eck fistula. The absorption of oxygen and excretion of carbon dioxide were determined both before and after the operation. It was found that the operation caused an increase in the oxygen absorption and in the carbon dioxide excretion, and also an increased respiratory quotient. These results are probably due to the inhibition of glycogen storage, owing to the liver being thrown out of circulation. There is consequently an increased destruction of the carbohydrates, which are thrown into the circulation. The increased respiratory quotient, which is particularly noticeable at some interval after the operation, is probably due to the conversion of the carbohydrate into fat.

S. B. S.

Starvation Metabolism. MIECZYSLAW HALPERN (*Biochem. Zeitsch.*, 1908, **14**, 134—142).—The urine of a patient unable to ingest either food or water, owing to cancer in the œsophagus, was analysed. The total daily excretion of nitrogen was 2·058 grams, or, excluding the protein nitrogen excreted, 2·0097 grams. This is less than that found in most other starvation cases, owing probably to the fact that the organism had gradually accommodated itself to a low diet. Other anomalies were also observed, for the ammonia nitrogen was only 3·47% of he total. The excretion of the acetone substances was also small. The purine substances were also small in amount, the daily excretion of purine nitrogen being only 0·05897 gram. The sodium chloride excretion was 0·05265 gram daily, whilst the ratio $N : P_2O_5$ was 6·3 : 1, which is normal and higher than in other starvation cases. The author discusses the possible reasons for the anomalies.

S. B. S.

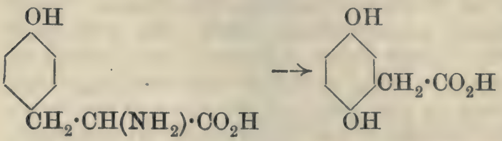
The Nutritive Value of Protein Cleavage Products. VIII. EMIL ABDERHALDEN (*Zeitsch. physiol. Chem.*, 1908, **57**, 348—362. Compare this vol., ii, 961).—Dogs react differently by feeding on protein cleavage products, some being attacked with vomiting. But in those which do not react in this way, equilibrium and health are well maintained. Complete details of the experiments are tabulated. The same result was obtained also with the products of acid hydrolysis of flesh and casein. If, however, the greatest part of the tryptophan and tyrosine was removed from the mixture beforehand, the results were not so good. W. D. H.

Phosphorus in Certain Foods WOLFGANG HEUBNER and M. REEB (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 265—272).—The phosphorus-containing substances in foods fall into five groups, namely, inorganic phosphates, phosphatides, nuclein, phosphoproteins, and esters of phosphoric acid. The position of inosic acid and phosphoramic acid in this classification is uncertain. A method is described for estimating these various compounds, and the results of the examination of various foods, meat, milk, bread, and other vegetable foods, are given in a table. W. D. H.

Absorption and Assimilation of Organic Compounds of Phosphorus. PIO MARFORI (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 378—388).—Natural glycerophosphoric acid differs from the synthetic substance in that its salts, when injected subcutaneously, yield, at least in part, assimilable phosphorus. The phosphorus of lecithin, and, to some extent, that of nucleo-proteins, is also assimilated under these conditions. Nuclein and nucleic acid from yeast, when given by the mouth, did not increase phosphorus assimilation. G. B.

The Cleavage of 2:5-Diketopiperazines in the Organism of the Rabbit. II. EMIL ABDERHALDEN and LEONHARD WACKER (*Zeitsch. physiol. Chem.*, 1908, 57, 325—328. Compare this vol., ii, 521).—In the further investigation of this question, it appeared desirable to employ an anhydride which is decomposed by alkali with difficulty. The one selected was *dl*-leucylglycine anhydride, and the experiments confirm those previously reported; this substance is in small measure resolved into its components by the organism of the rabbit. W. D. H.

The Degradation of Aromatic Substances in the Human Organism. LEON BLUM (*Arch. exp. Path. Pharm.*, 1908, 59, 273—298).—When administered to normal individuals, neither phenylalanine nor tyrosine, normal hydrolysis products of proteins, increase appreciably the aromatic contents of the urine. On the other hand, when given to alcaptonurics, they increase the homogentisic acid excretion in the urine. It has been assumed, therefore, that homogentisic acid is a normal intermediate product of metabolism of aromatic hydrolysis products of proteins, and that alcaptonuric individuals do not possess the power of completely utilising these products, and that tyrosine in the normal individual is first converted into homogentisic acid. This change can take place in the following ways: (*a*) the degradation may commence in the side-chain,

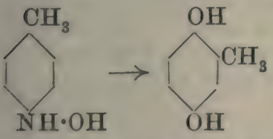


in which case *p*-hydroxyphenylacetic acid, or hydro-*p*-coumaric acid, $OH\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot CO_2H$, is first formed, and subsequently converted into homogentisic acid. It was found by Baumann and Schotten that hydro-*p*-coumaric acid, when administered to normal individuals, gave rise to *p*-hydroxybenzoic acid to the extent of 13%, whereas *p*-hydroxyphenylacetic acid was recovered to the extent of 78·6% in the urine. The author found that neither of these acids, on administration to alcaptonurics, caused an increase in the homogentisic acid output.

(*b*) A change in the relative positions of the hydroxyl group and the side-chain may take place with the formation of *m*- or *o*-tyrosine, which, on secondary oxidation in the para-position and a degradation of the side-chain, could give rise to homogentisic acid. It was found that neither of these tyrosines, when administered to alcaptonurics, increased the homogentisic acid output, and when given to normal individuals they were excreted in the form of the corresponding hydroxyphenylacetic acids to the extent of about 30%.

(*c*) The side-chain may be degraded to acetic acid, with a concurrent change in the relative position to the hydroxyl group, forming *m*- or *o*-hydroxyphenylacetic acid. Homogentisic acid would be formed from such products by subsequent oxidation in the para-position. This possibility was unlikely, as neither *o*- nor *m*-tyrosine gave rise to homogentisic acid, and it was also found that *m*-hydroxyphenylacetic acid, when administered to normal individuals, was found unchanged in the urine to the extent of 80%. Neither *o*- nor *m*-acid gave rise to increased homogentisic output in alcaptonurics.

(*d*) The processes of degradation, change of relative positions of the hydroxyl group to the side-chain containing the acid group, and of secondary oxidation, can take place concurrently. A similar change has been observed by Bamberger, who showed that tolylhydroxylamine is converted by hot dilute sulphuric acid into toluquinol. Other examples of similar action are also known, and quoted by the author. A change of this description must take place when tyrosine is converted into homogentisic acid. The results also indicate that homogentisic acid is a normal intermediate product of metabolism, as none of the products which were not fully destroyed in the normal individual gave rise to increased homogentisic output in alcaptonurics.



m-Tyrosine was prepared by the condensation of *m*-hydroxybenzaldehyde with hippuric acid. The lactimide of *m*-hydroxybenzoylaminocinnamic acid in the form of its acetyl derivative, $C_{16}H_{13}O_5N$, m. p. 149°, was obtained. On hydrolysis with 10% sodium hydroxide solution, *m*-hydroxybenzoylaminocinnamic acid, $C_{16}H_{13}O_4N$, m. p. 205—206°, was formed, which, on reduction with sodium amalgam, yielded *m*-benzoyltyrosine, $C_{16}H_{15}O_4N$, m. p. 180°. From this, *m*-tyrosine, $C_9H_{11}O_3N$, m. p. 280—281°, was obtained by hydrolysis with 20% hydrochloric acid.

o-Tyrosine was obtained by a similar synthetic method, although all the intermediate products were not obtained pure. *o*-Benzoyltyrosine melts at 176°, and *o*-tyrosine at 249—250°. S. B. S.

Are there Reducing Ferments in the Animal Body? ARTHUR HEFFTER (*Arch. exp. Path. Pharm., Suppl.*, 1908, 253—260).—The reduction processes which occur in animal organs or their extracts, or in vegetable tissues, have been attributed to enzyme action. Boiling does not abolish the action; this and other considerations lead the author to the conclusion that "reductases" do not exist.

W. D. H.

Spectroscopic Properties of Yolk of Egg. LOUIS LEWIN, A. MIETHE, and E. STENGER (*Pflüger's Archiv*, 1908, **124**, 585—590).—Attempts are being made to establish relationships between the colouring matters of egg-yolk and blood on account of the close morphological relationship between the blood and yolk. The first step in this direction has been the careful spectroscopic examination of the colouring matter of the yolk. The plates used for photographing the spectra were dyed with isocol. Solutions in water, acetone, alcohol, ether, chloroform, and benzene were examined. The solutions were found to follow Kundt's rule, for example, the absorption bands of the chloroform and benzene solutions were 5—10$\mu\mu$ nearer the red end of the spectrum than the corresponding bands of the other solutions.

There are three characteristic bands at 480, 453, and 427, and feebler bands at 400 and 378. No other yellow colouring matter gives the same absorption bands, and it is thus possible to detect adulterants of yellow of egg by spectroscopic measurements. J. J. S.

Chemico-physical Investigations on the Crystalline Lens. FILIPPO BOTTAZZI and NOÈ SCALINCI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 305—316. Compare this vol., ii, 966).—The crystalline lens contains an electro-negative protein, *facoprotein*, which is only soluble in water in the form of acid protein in absence of alkali, or of alkali protein, which is soluble also in absence of salts. The essential material of the lenticular fibre is, in normal conditions, a hydrogel of liquid or gummy consistency. The results are mainly of physiological interest. T. H. P.

Higher Fatty Acids in the Liver after Removal. JOHN B. LEATHES (*Arch. exp. Path. Pharm., Suppl.*, 1908, 327—336. Compare Abstr., 1904, ii, 355).—A full account of a research previously published, with a description of further experiments on the same lines. The increase of fatty acids previously noted does not invariably occur, but no light can be at present thrown on the nature of the processes involved. W. D. H.

The Formation of Uric Acid in the Liver of Birds. ERNST FRIEDMANN and H. MANDEL (*Arch. exp. Path. Pharm., Suppl.*, 1908, 199—207).—The experiments recorded were made by perfusing the surviving liver of the goose with various mixtures. If uric acid is added to the perfusion fluid, none is retained or destroyed by the liver. If urea and sodium lactate or malonate are added, there is no increase in uric acid formation. Uric acid formation in the bird's liver is therefore not the simple synthesis it has been considered to be.

W. D. H.

Action of Certain Gases on Autolysis. Luigi Bellazzi (*Zeitsch. physiol. Chem.*, 1908, **57**, 389—394).—Carbon dioxide favours, and oxygen is indifferent, or feebly inhibitory, towards, autolysis of the liver. W. D. H.

Decomposition of Caffeine by Extract of Ox-Liver. Y. Kotake (*Zeitsch. physiol. Chem.*, 1908, **57**, 378—381).—Extract of ox-liver decomposes caffeine into xanthine, hypoxanthine, *l*-methylxanthine, and paraxanthine. The removal of the methyl groups is prevented by boiling the extract, or by the use of such protoplasmic poisons as toluene or chloroform. The action is therefore attributed to a ferment. W. D. H.

Action of Drugs on the Mammalian Uterus. Harold J. Fardon (*Bio-Chem. J.*, 1908, **3**, 405—411).—The investigation of a number of drugs shows that the reaction of the uterus is that of a plain muscular organ supplied by sympathetic nerves, of both inhibitory and augmentative nature. Pregnancy and nicotine alter the relative influence of the two sets of fibres. W. D. H.

Inosite [in Flesh]. Franz Rosenberger (*Zeitsch. physiol. Chem.*, 1908, **57**, 464—467. Compare Abstr., 1908, ii, 873).—One factor in the presence or not of inosite, or of its precursor, inositogen, in flesh appears to be the time of year, which, as is well known, also affects the quantity of glycogen. W. D. H.

Hydrolysis of Fish Muscle. Thomas B. Osborne and Frederick W. Heyl (*Amer. J. Physiol.*, 1908, **23**, 81—89).—The results are compared with those previously published in relation to chicken muscle in the following table, where the figures show percentages of cleavage products:

	Halibut muscle.	Chicken muscle.
Glycine	0·0	0·68
Alanine	?	2·28
Valine	0·79	?
Leucine	10·33	11·19
Proline	3·17	4·74
Phenylalanine	3·04	3·53
Aspartic acid	2·73	3·21
Glutamic acid	10·13	16·48
Serine	?	?
Tyrosine	2·39	2·16
Arginine	6·34	6·50
Histidine	0·55	0·47
Lysine	7·45	7·24
Ammonia	1·33	1·67
Tryptophan	present	present
Total	50·25	62·15

The most marked difference is seen to be in the percentage yield of glutamic acid. W. D. H.

Cholesterol in Ox-Bile. Ernst Salkowski (*Zeitsch. physiol. Chem.*, 1908, 521—523).—Cholesterol can be easily prepared from the dried bile of commerce. Previous saponification is unnecessary. The view is held that cholesterol occurs as such in bile, not as an ester.

W. D. H.

Quantitative Researches on the Exhalation of Alcohols. JULIUS POHL (*Arch. exp. Path. Pharm., Suppl.*, 1908, 427—434).—The result of the experiments recorded is that alcohols of higher boiling points (*tert.*-amyl alcohol; *iso*propyl alcohol) are exhaled with the breath to a greater degree than those of lower boiling point (ethyl alcohol; methyl alcohol). This unexpected result cannot yet be explained.

W. D. H.

The Distribution of Nitrogen amongst the Various Products in Human Urine. LOUIS C. MAILLARD (*Compt. rend.*, 1908, **147**, 710—712).—The mixed urine from ten men of from 22—25 years of age was examined on six consecutive days. Of the total nitrogen excreted, 5·73% was in the form of ammonia, 81·29% in that of urea, 1·65% in that of purine compounds, 1·43% in that of uric acid, 0·22% in that of purine bases, and 11·15% in other forms of combination (creatinine, oxyproteic acids, urochrome, hippuric acid, amino-acids, etc.). The proportion of nitrogen to phosphorus was as 9 : 1·37. Muscular work was without appreciable influence on the total nitrogen excretion, although there was a slight diminution of urea, an undoubted increase in phosphates, and a slight increase in the nitrogen in the undetermined forms.

S. B. S.

Detection of Organic Bases in Urine. R. ENGELAND (*Zeitsch. physiol. Chem.*, 1908, **57**, 49—64).—Urine has been treated by the three following methods: 1. Precipitation of the urine with a cold saturated solution of mercuric chloride and sodium acetate (compare Johnson, Abstr., 1888, 506; 1889, 165). 2. Concentration of the urine and precipitation with tannin. 3. Precipitation of urine with a hot saturated solution of mercuric chloride and sodium acetate.

The bases isolated from the precipitate in the first method were creatinine and *as*-dimethylguanidine, the latter of which was obtained as the crystalline *aurichloride*, m. p. 144°.

The precipitate obtained according to the second method contained creatinine and methylguanidine, the latter of which was isolated as its aurichloride, m. p. 198°. It has been shown that the methyl- and dimethyl-guanidines are not produced by the action of hydrochloric acid on creatinine.

When the third method of precipitation was used, all the creatinine is removed, as the filtrate no longer gave Weyl's reaction. The bases isolated from the precipitate were creatinine, methylguanidine, vitiatine, histidine, a *base*, $C_{15}H_{36}O_{13}N_8$, similar to some of the protamines, and a *base*, $C_5H_7O_2N_3$, similar to histidine. The last base was isolated as its *picrolonate*, $C_5H_7O_2N_3,C_{10}H_8O_5N_4$, which crystallises in short needles, decomposing at 244°. The base gives a red coloration with alkali and copper sulphate, and also a dark red colour with an alkaline solution of diazobenzenesulphonic acid.

Iminazole derivatives are found in the urine of most animals, but herbivorous animals produce larger quantities of these compounds than do the carnivora. J. J. S.

The Regular Occurrence of Indole in the Distillate of Normal Urine. MAX JAFFE (*Arch. exp. Path. Pharm., Suppl.*, 1908, 299—308).—Indole is constantly found in the urine of man and other animals examined. The methods of obtaining and identifying it are given in full, the differences in quantity in various animals noted, and the conditions in which indole derivatives occur discussed.

W. D. H

Urinary Pigments derived from Indole. ALBERICO BENEDICENTI (*Arch. exp. Path. Pharm., Suppl.*, 1908, 64—74. Compare Abstr., 1907, ii, 980).—After subcutaneous administration, 5-methylindole appears in the urine as dimethylindigotin; 2:5-dimethylindole forms a red colouring matter, and α-naphthindole yields a reddish-brown coloration, changing later to bluish-green. G. B.

Excretion of Urobilin in Disease. N. F. SURVEYOR (*Bio-Chem. J.*, 1908, **3**, 439—448).—From an examination of 500 specimens of urine in health and disease, the conclusion is drawn that there is no correspondence between the amount of urobilin excreted and the amount of ethereal sulphates in the urine. Urobilin formation is therefore not the result of intestinal putrefaction. Disease of the liver also does not seem to be responsible for its appearance. The method adopted for the estimation of urobilin is the depth of the absorption band in an amyl-alcoholic extract of the urine, and so far as any conclusion can be drawn from the inconstant results found in most diseases, it appears that conditions that lead to hæmoglobin destruction are those most likely to produce increase of the urinary urobilin. W. D. H.

Microchemical Changes occurring in Appendicitis. OWEN T. WILLIAMS (*Bio-Chem. J.*, 1908, **3**, 391—401).—The author considers that intestinal sand (Abstr., 1907, ii, 906) consists largely of calcium salts (soaps) of saturated fatty acids. These soaps are not so easily absorbed as those derived from unsaturated fatty acids.

Action of Radium Emanations [in Diabetes]. E. POULSSON (*Arch. exp. Path. Pharm., Suppl.*, 1908, 443—448).—It is well known that many mineral waters contain radium. Cases of diabetes were treated with radioactive water. In two severe cases, no good was done; in a third case, where the disease was not so malignant, the excretion of sugar was lessened, although whether this was due to the water is uncertain. W. D. H.

The Degradation of Fatty Acids in Diabetes Mellitus. JULIUS BAER and LEON BLUM (*Arch. exp. Path. Pharm.*, 1908, **59**, 321—330).—It has been shown previously (compare Abstr., 1907, ii, 285) that *iso*valeric acid gives rise to β-hydroxybutyric acid in severe cases of diabetes mellitus, and leucine acts in a similar way; no great difference could be detected in the relative amounts excreted. Experiments were made in mild cases of the disease, and it was found that *iso*valeric acid exerted but little influence on the excretion of the hydroxybutyric acid; *n*-butyric and hexoic acids caused, however, an increased output. Similar results were not obtained in all the cases investigated. S. B. S.

The Influence of Muscular Work on the Excretion of Sugar in Pancreas Diabetes. Y. Seo (*Arch. exp. Path. Pharm.*, 1908, **59**, 341—363).—Experiments were carried out on dogs which had been either wholly or partly deprived of the pancreas. The excretions of nitrogen and sugar were determined during periods of rest and periods of work, when the animals turned a treadmill. In animals in which the pancreas had only been partly removed, it was found that muscular work diminished the excretion of sugar. This was not the case, however, in animals on which total extirpation of the pancreas had been performed. In these cases, the ratio dextrose : nitrogen increased during the periods of work. The conclusion is drawn that increased utilisation of sugar by muscular work can only take place when some functioning pancreas tissue remains in the organism. S. B. S.

Acidosis in Pancreas Diabetes. Eduard Allard (*Arch. exp. Path. Pharm.*, 1908, **59**, 388—396).—Brugsch and others have maintained that acidosis is not found in cases of severe pancreas diabetes. The author cites, however, several experiments made with dogs deprived of the pancreas, in which a comparatively large output of β-hydroxybutyric acid was observed. The phenomenon of acidosis in these cases is, however, a very inconstant one, and it is suggested that it is due to secondary causes. The liver, or other parenchymatous tissue, in the advanced stages of the disease may have lost the power of degrading acetoacetic acid or acetone to simpler substances.
S. B. S.

Radioactivity of Goitrigenic Springs. Répin (*Compt. rend.*, 1908, **147**, 703—705. Compare this vol., ii, 796).—The author has measured the radioactivity of the water of fourteen springs, a well, and several torrents situated in districts where goitre is endemic. The springs issuing from faults at the base of high mountains were all found to be radioactive, whilst surface water and torrents fed by glaciers or snow were inactive. Torrent waters when without turbidity are preferred, and the people who use them are free from goitre. A goitrous family living in a non-goitrous district was employing a radioactive well water. The prevalence of goitre in mountainous districts, and the success of distilled water in treating it, also suggests a connexion between radioactive water and the disease. The radioactivity has the character of radiothorium. R. J. C.

The Pathogenesis of Ochronosis. Oscar Gross and Eduard Allaret (*Arch. exp. Path. Pharm.*, 1908, **59**, 384—387).—The colouring of cartilage in the pathological condition known as ochronosis is due to the same anomaly in metabolism that produces alcaptonuria, namely, the production of homogentisic acid, which is not destroyed in the organism. The cartilage appears to have the property of attracting this acid and converting it into a dark pigment, producing in this way a form of arthritis, designated by the authors arthritis alcaptonurica. Almagia has shown that in cartilage soaked in solutions of sodium urate, concretions are formed similar to those found in cases of gout, and the authors show that cartilage in nearly neutral homogentisic acid solutions acquires a dark colour similar to that observed in cases of ochronosis. Other tissue does not act in this way. S. B. S.

A Case of Chronic Pentosuria. RICCARDO LUZZATTO (*Arch. exp. Path. Pharm., Suppl.*, 1908, 366—377).—The urine of the patient (who has remained in good health for many years) contains generally 0·1% of *l*-arabinose. The amount is not affected by ingestion of large quantities of dextrose, sucrose, or starch, but is increased by galactose, by alkalis, and by intellectual work, and diminished by the ingestion of hydrochloric acid, and apparently also by excessive muscular labour. Pentosuria is therefore quite distinct from diabetes. In order to determine the reducing power of the urine, lead acetate is added, and, after filtration, ammonia; the basic lead precipitate formed carries down all the pentose, and is then redissolved in acid. G. B.

Contents of a Cystic Tumour of the Breast. EMIL ZDAREK (*Zeitsch. physiol. Chem.*, 1908, **57**, 461—463).—A complete analysis of the contents of a so-called butter-cyst of the mammary gland is given. It occurred in a woman, forty years of age, and had lasted twelve years before it was removed. It was about the size of an apple. It contained 48% of water, 38·6% of fat, 7·5% of fatty acids, 3% of coagulable protein, 1% of caseinogen, and 1·6% of ash. W. D. H.

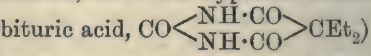
Action of Barium Chloride, Adrenaline, and Peptone on the Vaso-motor Apparatus. L. POPIELSKI (*Arch. exp. Path. Pharm., Suppl.*, 1908, 435—442).—The three substances named all act on the peripheral vaso-motor mechanism. Barium chloride and adrenaline cause a rise of pressure by acting on the musculature; Witte's peptone causes a fall by acting on the nerve-endings in the vessels. The substance responsible for the activity of Witte's peptone is named *vaso-dilatin*, it is not a protein, nor is it choline, which when pure produces the opposite effect. Vaso-dilatin is also the substance which renders the blood incoagulable. W. D. H.

Action of Certain Narcotics on Nerve. ALBRECHT BETHE (*Arch. exp. Path. Pharm., Suppl.*, 1908, 75—82).—The excitability of nerve and its reaction to the constant current (polarisation picture) go hand in hand. Solutions of chloral hydrate, ethylurethane, and phenylurethane, which abolish the excitability, also abolish the normal polarisation changes. If the dose of the narcotic is insufficient to completely abolish excitability, the polarisation changes are altered in like measure. When these changes are produced, immersion in

Locke's solution causes the nerve to recover. This reversibility is least easy to obtain after chloral hydrate. W. D. H.

Pharmacological Action of Certain Lactones and the Corresponding Hydroxy-acids. Charles R. Marshall (*Arch. exp. Path. Pharm., Suppl.*, 1908, 389—394. Compare Abstr., 1906, ii, 788). —Certain tropeines containing a lactone group (Jowett and Hann, Trans., 1906, **89**, 357; Jowett and Pyman, Trans., 1907, **91**, 92), and possessing an atropine-like action, lose this action when they are converted into salts of the corresponding hydroxy-acids. After the addition of a molecular quantity of alkali hydroxide, this conversion occurs relatively slowly towards the end of the reaction, and the gradual change can be demonstrated pharmacologically. G. B.

Behaviour of Sodium Salicylate in the Organism. Alessandro Baldoni (*Arch. exp. Path. Pharm., Suppl.*, 1908, 54—63).—Sodium salicylate, when administered to dogs, is mostly excreted unchanged in the urine, but a small portion is converted into two crystalline derivatives with acid properties, both yielding a blue coloration with ferric chloride and having a strong reducing action. Of these, one, m. p. 169—170°, has the composition $C_{16}H_{16}O_8N$; the other, m. p. 187—188°, has the composition $C_{15}H_{14}O_8$. Salicyluric acid, which is found in human urine after ingestion of sodium salicylate, cannot be detected in dogs' urine. G. B.

Pharmacological Significance of Twin Ethyl Groups. Sigmund Fränkel (*Arch. exp. Path. Pharm., Suppl.*, 1908, 181—187). —In order to test the hypothesis, that the hypnotic action of such drugs as veronal (diethylbarbituric acid,  $\mathrm{CO}<\begin{matrix}\mathrm{NH\cdot CO}\\ \mathrm{NH\cdot CO}\end{matrix}>\mathrm{CEt_2}$) is due to two ethyl groups attached to the same carbon atom of the ring, the author has examined tetra-, penta-, and hexa-ethylphloroglucinol, and also the hexamethyl derivative. None of these substances has a hypnotic action, but they produce strychnine-like convulsions. G. B.

Pharmaco-dynamic Characters of Coumarin. Alexander Ellinger (*Arch. exp. Path. Pharm., Suppl.*, 1908, 150—163.)—The toxic action of cantharidin on the kidneys suggested the examination of other substances with a lactone structure, and coumarin was selected. In rabbits, albuminuria may occur, but only to any extent when the urine is acid. The injury to the kidneys, even in large doses, is never serious. Coumarin, however, in frogs causes deep narcosis, owing to its action on brain and cord; the centres affected include those governing cardiac inhibition and respiration, but the vaso-motor centre is not affected. In rabbits it is, in suitable doses, a harmless narcotic, and has no effect on the heart; large doses injected intravenously paralyse the respiration and produce death. In dogs, also, it is a narcotic, and usually produces vomiting. In large doses it kills them, but without the characteristic symptoms noticed in rabbits. This difference in action is probably related to a difference in excretion in the two animals, but this part of the work is still in progress. W. D. H.

Behaviour of Atropine in Various Animals. MAX CLOETTA (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 119—125).—Atropine appears to be destroyed in the brain and liver; this is most marked in the rabbit's brain, and least in the cat. This appears to be related to what is termed the "vital reaction difference" of the nervous tissues of various animals, and is not yet explicable on a chemical or physical basis. W. D. H.

Action of Caffeine on Frogs. CARL JACOBJ and GOLOWINSKI (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 286—298).—The relative difference in the action of caffeine on the two species of frog (*Rana esculenta* and *R. temporaria*) has been attributed to differences in the excitability of the spinal cord. The present research deals mainly with the difference between the muscles of the two species. The difference is mainly one of elasticity and extensibility, and this, as well as the different behaviour of caffeine towards them appears to depend on the sarcolemma of the muscular fibres, and the amount or character of its lipoids. W. D. H.

The Fate of Synthetic Muscarine in the Animal Body. HERMANN FÜHNER (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 208—213).—If muscarine is given subcutaneously to tortoises, it is again obtainable in the urine during the next few days in active form, and but little, if at all, altered in amount. The same is true for curarine. W. D. H.

Poisons of Amanita Phalloides. JOHN J. ABEL and WILLIAM W. FORD (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 8—15. Compare Abstr., 1907, ii, 192).—Further details are given of the properties and actions of the two poisons contained in this fungus, namely, the hæmolysin, which is a glucoside containing pentose, and the toxin. The hæmolysin is easily destroyed by the gastric juice, so that, if taken by the stomach, it does not manifest its hæmolytic properties. W. D. H.

Action of Atoxyl on the Animal Body. J. IGERSHEIMER (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 282—285).—Although sodium *p*-aminophenylarsinic acid may have its proper sphere of action in dealing with diseases due to protozoa (trypanosomiasis, syphilis, etc.), it should be recognised that its other name, *atoxyl*, is an illusory one, and in man it produces effects on the nervous, excretory, and alimentary system, Details are given of its toxic action on a number of dogs and cats. W. D. H.

Action of Poisons on Enzymatic Processes. KARL G. SANTESSON (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 469—481).—It is suggested that the harmful influence of such poisons as hydrocyanic acid on the heart and on plant life is due to interference with intracellular enzymes, the action of which forms the basis of the activity of living cells. In support of this view, experiments are recorded with muscle extract, and the action of the catalase in it was measured by the evolution of gas which occurs when mixed with hydrogen peroxide. This action is favoured by dilute alkali, hindered by dilute acid, by hydrocyanic acid, and also by manganese sulphate in decinormal solution; but in concentration $N/1000$ the development of gas is slightly increased; the favouring action of dilute solutions of manganese salts on other enzymatic processes is well known.

W. D. H.

Poisoning with Potassium Chlorate. L. Riess (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 460—468).—The hæmolysis which follows poisoning with potassium chlorate is of a specially pernicious character, and differs from other cases of hæmolysis in that the corpuscles are broken up, so that irregular clumps of hæmoglobin are formed. The urinary tubules become filled with similar particles, although how they pass the renal epithelium is a difficulty; these tubules, especially in chronic cases, get filled with these particles, which blend so as to form casts of the tubules. W. D. H.

Post-mortem Action of Corrosive Poisons in the Stomach. Erich Harnack and Hermann Hildebrandt (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 246—252).—In forensic medicine, the degree of action of a caustic poison after death is sometimes raised. It is shown by experiments on cats that their destructive action on the gastric mucous membrane is more marked after death than during life. The action of potassium cyanide on the blood pigment also occurs post-mortem, but absorption of ammonia from the stomach only takes place during life. W. D. H.

Chronic Oleic Acid Poisoning. Edwin S. Faust (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 171—175).—The idea that the anæmia in those afflicted with the tape-worm, ***Bothriocephalus***, is due to oleic acid contained as a cholesterol ester in the worm acting as a hæmolytic poison, led to the present research, in which it is shown by experiments on rabbits and dogs that oleic acid administered by the mouth or subcutaneously over long periods of time does act as a hæmolytic agent in the same way as it does *in vitro*; the red corpuscles are diminished in number, and the hæmoglobin is lessened in amount. W. D. H.

So-called Antitoxic Power of Animal Tissues towards Strychnine. Paul Pellacani and Folli (*Arch. exp. Path. Pharm.*, *Suppl.*, 1908, 419—426).—Proofs are adduced that the tissues do not possess the power of destroying strychnine; practically the whole of it (98%) can be recovered from the tissues many hours after its introduction. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Estimation of the Reducing Power of Bacteria and Animal Organs. HEINRICH WICHERN (*Zeitsch. physiol. Chem.*, 1908, **57**, 365—377).—An important distinction between different micro-organisms is their relative reducing powers, and most methods hitherto employed are defective from the quantitative aspect. It is, however, possible to obtain good results with certain coloured substances, the colour of which disappears on reduction; of these, methylene-blue appears to be the best. Still better results are obtained with ferric chloride and titration with titanium trichloride. This is illustrated by the experiments recorded with various bacteria. The method as applied to pieces of organs is not so useful, although fairly concordant results are obtained with extracts of organs. It is suggested that the same method might be employed for the estimation of the activity of oxydases. W. D. H.

Bacterial Formation of Sulphates in Sewage Purification. CH. ROUCHY (*J. Pharm. Chim.*, 1908, [vi], **28**, 439—444).—The opalescence or milkiness of effluents from inefficient bacterial sewage beds is due to the presence of finely-divided sulphur. In the limpid effluents from beds which are working properly, the sulphur has been entirely converted into sulphuric acid, which, reacting on the carbonates in the sewage, is converted into sulphates. This formation of sulphuric acid is, the author thinks, due to the oxidising action of special bacteria, analogous to the nitrifying organisms. T. A. H.

Oxidation by means of Moulds. REGINALD O. HERZOG and A. MEIER (*Zeitsch. physiol. Chem.*, 1908, **57**, 35—42. Compare Harden, Trans., 1903, **83**, 424).—Cultures of *Penicillium glaucum* were grown in dilute beer wort, and when the evolution of carbon dioxide had reached a constant value, a solution of the ammonium salt of a hydroxy-acid was added. The evolution of carbon dioxide was increased considerably, and each experiment was continued until the evolution had fallen again to the normal value for the medium. In this way, the carbon dioxide due to the decomposition of the hydroxy-acid could be calculated. The following acids were readily attacked: lactic, tartaric, malic, mandelic, β-hydroxybutyric, and in every case the amount of carbon dioxide evolved was considerably in excess of that calculated for the amount of acid destroyed.

Glycollic, citric, pyruvic, and hydroxy*iso*butyric acids were not affected.

The conclusion is drawn that the process is one of oxidation, but is accompanied by another unknown reaction, which also gives rise to carbon dioxide.

It has been shown that, when the organism has been destroyed by acetone or methyl alcohol, it can still decompose the hydroxy-acids, thus indicating that the reaction is due to an oxidising enzyme. The activity of the dead cells is not so marked as that of the living, and ceases after some thirty-six hours. J. J. S.

Conversion of Cinnamic Acid into Styrene by means of Moulds. Reginald O. Herzog and O. Ripke (*Zeitsch. physiol. Chem.*, 1908, **57**, 43—45. Compare Oliviero, Abstr., 1906, ii, 623).—Styrene is formed when *Aspergillus niger* is grown in dilute beer wort containing ammonium cinnamate (0·25% solution). The amount of hydrocarbon formed can be determined by aspirating sterilised air through the liquid, and then passing it through ten bulbs containing carbon disulphide. The styrene is weighed as its dibromide.

Attention is drawn to the importance of this type of reaction for the explanation of the formation of mineral oil deposits. J. J. S.

Transformations of the Chromogenic Matter of Grapes during Maturation. J. Laborde (*Compt. rend.*, 1908, **147**, 753—755).—It has been shown previously (this vol., ii, 774) that the colouring matter of red grapes can be artificially produced from the œnotannin of the unripe grapes. The object of the present work is to discover how the transformation is effected naturally. The tannins exist in the green pellicles in two forms: (1) soluble in strong alcohol, (2) insoluble in this solvent, the latter being the greater in amount. By determination of the amounts of these tannins in various species of red and white grapes, in varying states of maturity, by means of a colorimetric method described, it is shown that the total quantity of tannin matter diminishes, the proportion of the soluble tannin increases, and that of the insoluble tannin diminishes, during ripening. It is during this change of the insoluble into soluble tannin that the colouring matter of the red grapes appears. Colorimetric examination of the hydrochloric acid solution from the pellicles of grapes just commencing to ripen, before and after heating in an autoclave, shows that they contain untransformed œnotannin; with the ripe grapes this is not observed. The œnotannin in the wine must therefore proceed from other solid parts. The soluble tannin obtained from the pellicles of ripe white grapes gives only an insoluble, brown colouring matter when heated with 2% hydrochloric acid in an autoclave. The change in solubility of the tannin is probably due to diastatic action, and this raises the question whether it is an enzyme which transforms the œnotannin into the colouring matter of red grapes; if so, this enzyme must be absent from the white grapes. All attempts to find such an enzyme have, however, proved unsuccessful. E. H.

Carbohydrates of Coelococcus and Phytelephas. Sergius Ivanoff (*J. Landw.*, 1908, **56**, 217—228).—Ground *Coelococcus* shavings, when hydrolysed with 6% sulphuric acid, yielded 20% of mannose; *Phytelephas macrocarpa* gave 37%. No other hexose was produced in appreciable quantity. Both substances yielded arabinose when boiled with 2—3% sulphuric acid; xylose could not be detected. Mannose was found to be present in two modifications, as hemicellulose and as mannocellulose. N. H. J. M.

Indole in Flowers. F. Weehuizen (*Pharm. Weekblad*, 1908, **45**, 1325—1329).—Indole can be detected in the white flowers of *Murraya exotica* by the action of vanillin or *p*-dimethylaminobenzaldehyde on the alcoholic extract in presence of concentrated hydrochloric acid. Each reagent produces a red coloration, that with *p*-dimethylaminobenzaldehyde being more intense in presence of sodium nitrite. Since phloroglucinol answers to the same test when it is present, the vapour exhaled from the flowers should be allowed to come into contact with the reagents. A. J. W.

Abnormal Biochemical Products of the Rue Anemone. Frederick S. Beattie (*Amer. Chem. J.*, 1908, **40**, 415—428.)—Fasciated specimens of rue anemone (*Syndesmon thalictroides*) contain about 20% of methyl and ethyl *iso*carbostyril-3-carboxylates and 3-methylquinoline-4-carboxylic acid. These substances are not found in the normal plant. J. C. C.

Preparation of Pure Chitin from Boletus edulis. Emil Scholl (*Monatsh.*, 1908, **29**, 1023—1036).—The membranes of *Boletus edulis* consist chiefly of chitin in loose combination with carbohydrates. It has been found possible to prepare pure chitin from this fungus to the extent of 5 to 6% of the dried plant by alternate treatment with boiling water and boiling 10% aqueous potassium hydroxide. The chitin so obtained is chemically identical with animal chitin, and is, unlike Winterstein's fungus-cellulose (Abstr., 1896, ii, 210), completely insoluble in concentrated alkalis. It yields about 78% of crystalline glucosamine hydrochloride when hydrolysed with hydrochloric acid. W. H. G.

Peptolytic Ferments in Germinating and Ungerminated Seeds of Various Plants. Emil Abderhalden and Dammhahn (*Zeitsch. physiol. Chem.*, 1908, **57**, 332—338).—The existence of proteolytic enzymes in plants has been established by the work of Schulze and Winterstein. Schittenhehm found also peptolytic ferments in seeds, and this observation is confirmed; extracts of the seeds of wheat, maize, barley, and lupins produce splitting of glycyl-*l*-tyrosine if the seeds have germinated. In the resting stage, peptolytic ferments are absent. W. D. H.

Assimilation and Elimination of Nutrients by Oats at Different Periods of Vegetation. L. Seidler and Albert Stutzer (*J. Landw.*, 1908, **56**, 273—278).—Pot experiments with oats in two different soils (a heavy loam mixed with gravel and a chalky gravel mixed with peat), manured with superphosphate and sodium nitrate and with varying amounts of potassium chloride. The plants were analysed (1) four weeks after sowing the seed, (2) when the ears began to form, (3) at the period of full flower, and (4) when the ripening was complete.

As regards nitrogen, it was found that from 50 to 60% of the total amount assimilated was taken up in the first four weeks, and that the ripe plants contained from 6 to 26% less nitrogen than at the third period. The highest amounts of potassium were also found in the third period, the losses during ripening increasing, with some exceptions, with the amount of potassium chloride applied.

Sodium, calcium, and phosphoric acid seem to be retained by the plants to the end; slight losses of calcium occasionally took place between the third and fourth periods. N. H. J. M.

Influence of Different Manurial Conditions on the Assimilation of Nutrients and the Structure of Plants. Max Wagner (*Landw. Versuchs-Stat.*, 1908, **69**, 161—233).—Two series of pot experiments in which mustard, buckwheat, barley, and oats were grown under different manurial conditions. In the second series, plants were taken up and analysed at four periods of growth (May 9 and 29, June 25 and July 13).

As regards the final amount of growth above ground, both the oats and the barley, which ripened completely, generally showed a loss, especially when insufficiently manured. Deficiency of nutrients, especially nitrogen, resulted in a higher relation of roots to above ground growth.

A deficiency of phosphoric acid in soil otherwise sufficiently manured reduced the yield of barley most, then oats, buckwheat, and mustard. When potassium was deficient, barley again suffered most, then oats and mustard, and lastly buckwheat.

Whilst the buckwheat, which remained green to the fourth period, continued to take up the different nutrients to the end, the oats, barley, and mustard showed losses of nitrogen, potassium, and phosphoric acid at the final period.

The relation of grain to straw was considerably affected by the conditions of manuring. In the case of barley, a low relation of grain was most marked when potassium was deficient, whilst with oats, deficiency of nitrogen caused the greatest reduction.

N. H. J. M.

Amount of Nutrients Utilised by Sugar-Beet in the First Year and its Relation to the Amount of Sugar in the Roots. Karl Andrlík and Josef Urban (*Zeitsch. Zuckerind. Böhm*, 1908, **33**, 83—94. Compare *ibid.*, 1906, **31**, 149; 1907, **32**, 559).—The amount of phosphoric acid assimilated by sugar-beet depends on the manuring and the amount present in the soil, on the rainfall, and on the seed. With a yield of 400 quintals of roots, the amount of phosphoric acid taken up under normal conditions varied from 51·7 to 87·8 kilos., whilst in a dry season the average amount was 48·6 kilos.

The amount of phosphoric acid required to produce 100 parts of sugar also varies according to manurial and climatic conditions. The results of various experiments made from 1902 to 1905 showed that the average amount is 0·97 part of P_2O_5, the amount deposited in the roots being 48·4% of the total. N. H. J. M.

Digestibility of Hay from Water Meadows as Compared with Ordinary Hay. Konrad Friedländer (*Landw. Versuchs-Stat.*, 1908, **69**, 245—258).—The hay from water meadows is characterised by a high percentage of mineral matters and a very high percentage of crude protein. The results of feeding experiments with sheep showed that the digestibility of the crude protein is distinctly higher, and of the true protein appreciably higher, than in the case of ordinary hay. The latter contains, however, a higher amount of carbohydrates.

N. H. J. M.

Studies on the Soils of the Northern Portion of the Great Plains Region: Nitrogen and Humus. Frederick J. Alway and Robert S. Trumbull (*Amer. Chem. J.*, 1908, **40**, 147—149. Compare Abstr., 1907, ii, 294).—Determinations of total nitrogen, soluble humus, and the nitrogen in the soluble humus in nineteen comparatively heavy soils and one sandy soil from Saskatchewan and Alberta. The percentages of total nitrogen are fairly high in all the soils except the sand, whilst the humus is rather low, although much higher than in the arid soils of California. The proportion of the total nitrogen present in the form of humus is decidedly low. The percentage of nitrogen in the humus is not markedly different from that of soils from humid regions.

The results seem to indicate that the surface soils of the semi-arid portions of Western Canada have the characteristics of humid regions, whilst the sub-soils show the peculiarities of other arid regions.

N. H. J. M.

Isolation of Dihydroxystearic Acid from Soils. Oswald Schreiner and Edmund C. Shorey (*J. Amer. Chem. Soc.*, 1908, **38**, 1599—1607. Compare this vol., ii, 889).—Four out of six more or less unfertile soils were found to contain dihydroxystearic acid, identical with the one obtained from elaidic acid (Saytzeff, Abstr., 1886, 140). The soil which yielded most of the substance was a grey silt loam from Tennessee, which had been under cultivation for more than fifteen years chiefly in cotton. The soil contains organic matter 3·26, and nitrogen 0·16%. The amount of fairly pure substance obtained from 1 kilo. of soil was about 0·05 gram; the amount actually present is probably far greater.

As regards the toxicity of dihydroxystearic acid, experiments with wheat seedlings show that as little as 20 parts per million is distinctly injurious; 100 parts per million reduced the weight to 53%, whilst 200 parts per million (approximately a saturated solution) had about the same effect. Practically the same results were obtained with dihydroxystearic acid, prepared from elaidic acid, and with the isomeric acid from oleic acid, the weight being reduced to about half of that in the control experiment, and the plants being killed in twelve to fifteen days.

The Takoma soil previously examined (*loc. cit.*), which also contains dihydroxystearic acid, seems to be a good medium for fungi. Rootlets of oak trees growing in the soil were found to be infested with mould, and when freed from soil yielded small quantities of the acid. The conclusion is drawn that the dihydroxystearic acid is produced by the moulds, perhaps by the decomposition of lecithins into oleic acid, conversion of oleic acid by nitrous acid into elaidic acid, and oxidation of the latter by enzymes or micro-organisms.

N. H. J. M.

Ammonia Question. Paul Ehrenberg (*Landw. Versuchs-Stat.*, 1908, **69**, 259—294. Compare this vol., ii, 60).—Experiments on the production of basic and acid reactions in peaty soil, by application of nitrogen in the form of potassium or sodium nitrate and ammonium salt respectively, and on the effect of the reactions on different plants. Experiments were also made in which ammonium sulphate was applied both with and without calcium carbonate.

As an example of the effect of the two forms of nitrogen (in absence of calcium carbonate) on the growth of plants in an acid soil, it is shown that maize, sorghum, barley, and white mustard during the first periods of growth cause the acidity of the soil to be neutralised when manured with nitrate, and then produce normal growth. At the same time, the assimilation of potassium and other bases tends to maintain the change of reaction within certain limits. The same plants, manured with ammonium sulphate, were able, with the exception of mustard, to make a start under the conditions of slight soil acidity, but after reaching a certain point fell off, owing to the increased acidity resulting from the sulphuric acid of the ammonium salt. Mustard is the most sensitive to ammonium salts, and maize the least sensitive, owing probably to the greater amount of soil it produces.

N. H. J. M.

Old and New Nitrogenous Fertilisers: Calcium Cyanamide, Calcium Nitrate, Ammonia Sulphate, and Sodium Nitrate. Vittorio Nazari (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 334—342).—The author has investigated the influence of various factors on the fertilising value of calcium cyanamide, and has carried out experiments on the comparative values of calcium cyanamide, calcium nitrate, ammonium sulphate, and sodium nitrate as fertilisers. The crop used, in all cases, was wheat.

The results show that the value of calcium cyanamide is greatly enhanced by the presence in the soil of organic matter in the form of stable manure. The cyanamide acts most beneficially at about 20 cm. below the surface of the soil, and at a depth of 5 cm. gives much less favourable results than at a depth of 35 cm. The best fertiliser to use in association with calcium cyanamide is bone superphosphate, partly owing to the fact that it contains a certain proportion of readily fermentable matter, which serves to nourish the micro-organisms; also, admixture of the cyanamide with gypsum gives better results than admixture with lime, owing to the action of the calcium sulphate on the soil constituents containing insoluble potassium compounds, and to its stimulating action on many of the lower forms of plant life. On treating the soil with equal amounts of nitrogen in the form of the various fertilisers, the best and approximately identical results were obtained with calcium nitrate, ammonium sulphate, and sodium nitrate, calcium cyanamide yielding a considerably inferior crop.

T. H. P.

Danger of Employing Salts of Arsenic in Agriculture. W. MESTREZAT (*J. Pharm. Chim.*, 1908, [vi], 28, 393—397).—Wines manufactured from untreated vines are found to contain 0·000005 to 0·000008 gram of arsenic per litre, whilst those from vines which have been cultivated on the same soil and in the same manner as the preceding, except that they have been treated three times with various arsenical preparations (as insecticides), contain 0·000020 to 0·000025 gram of arsenic per litre. The danger from this cause is accordingly negligible. Inappreciable quantities of arsenic are found to be inhaled by workmen who have to prepare the arsenic salts for use, whilst the quantities settling on their hands and faces (0·0007 to 0·0012 gram) are probably innocuous. E. H.

Analytical Chemistry.

New Burette Clamp. GUSTAV MÜLLER (*Zeitsch. angew. Chem.*, 1908, 21, 2318—2319).—To a retort stand with a tripod base are fixed one or more clamps so constructed that they may be moved and turned both horizontally and vertically. Hence it is immaterial whether the stand is perfectly level, for the burettes may be always properly adjusted.

A retort stand with the rod fixed in the centre of the oblong base may also be used; the rod should consist of two parts, which may be unscrewed if desired. The base is provided with a hole, so that it may be attached to the wall; the clamps are then fixed to the protruding rod. From the rod may be suspended a variety of laboratory sundries, such as towels, brushes, etc., so as to economise space.

L. DE K.

Rapid Method of Qualitative Analysis. W. BRANCH POLLARD (*Chem. News*, 1908, 98, 211).—One part of the finely-powdered substance is mixed with 1 part of vaseline and 5 parts of sodium peroxide. The mixture is placed on a thick iron plate, or in the cavity of a scorifying mould, and ignited by means of a match or a Bunsen burner. The fused mass is extracted with water, and both the soluble and insoluble matter tested as usual. The soluble portion contains, in the highest state of oxidation, those elements which form soluble sodium salts; the insoluble portion contains the oxides and carbonates of the other metallic elements.

A special test should be made for mercury and sodium. The method is more particularly suited for examining ores and minerals in the field. L. DE K.

Detection of Hydrogen Peroxide in Milk. W. PERCY WILKINSON and ERNST R. C. PETERS (*Zeitsch. Nahr. Genussm.*, 1908, 16, 515—517).—The reaction described by Feder (Abstr., 1908, ii, 318) is shown by

the authors' experiments to depend on the actual quantities of hydrogen peroxide and formaldehyde present, and also on the proportion of these two substances to each other. The strongest reaction is obtained when from 0·004 to 0·013% of formaldehyde and about 0·005% of hydrogen peroxide are present in the milk. If the amount of hydrogen peroxide is increased to 0·5%, a coloration is not obtained. Ferric salts, nitrates, etc., also influence the reaction, so that a positive reaction is not a definite proof of the presence of hydrogen peroxide. The test proposed by the authors (Abstr., 1908, ii, 907) for distinguishing between raw and heated milk may be applied conversely to the detection of hydrogen peroxide; it is not affected by the presence of nitrates or ferric salts.
W. P. S.

Pringsheim's Method for Estimating Chlorine, Bromine, and Iodine in Organic Compounds. ERIK J. VIRGIN (*Arkiv Kem. Min. Geol.*, 1908, **3**, No. 12, 1—6).—The author has investigated the method proposed by Pringsheim (compare Abstr., 1904, ii, 146, 447; 1905, ii, 609) for estimating halogens in organic compounds by means of sodium peroxide.

With 1 : 4-dichloronaphthalene tetrachloride, 3 : 4-dichlorophenol, and *p*-bromoaniline, this method gives low results, whilst with *p*-dibromobenzene and iodoform good results are obtained.

The method is only applicable to substances which burn quietly with the sodium peroxide, and give no smoke or flame outside the crucible. As it is impossible to tell beforehand if this will be the case, and as there is no definite limit between quiet and vigorous combustion, the method is not to be recommended. T. H. P.

Kjeldahl's Method. ERNST SALKOWSKI (*Zeitsch. physiol. Chem.*, 1908, **57**, 523—526).—Some practical details in the employment of this method are given as the result of the author's experience. Among other points, the omission of the addition of mercuric oxide is recommended. W. D. H.

Micro-chemical Reactions of Arsenic Applicable to Medico-Legal Investigations. GEORGES DENIGÈS (*Compt. rend.*, 1908, **147**, 596—597).—A description of the technique is given for identifying arsenic by microscopical methods, the reagents employed being silver nitrate in solutions acidified by acetic acid, and in ammoniacal solutions. The reactions are carried out with a drop of arsenical liquid, which has been evaporated to dryness with certain precautions, on an object glass. S. B. S.

Mercurous Nitrate as a Microchemical Reagent for Arsenic. GEORGES DENIGÈS (*Compt. rend.*, 1908, **147**, 744—745. Compare preceding abstract).—The reagent is prepared by triturating crystallised mercurous nitrate (10 grams) with nitric acid (D 1·39, 10 c.c.) and adding water (100 c.c.). A small drop of the solution (in nitric acid) to be tested is evaporated to dryness on a glass plate by a gentle heat, and the residue treated with a drop of ammonia, which is also evaporated. To the residue, when quite cold, a drop of the mercurous reagent of a volume insufficient to completely cover it is added.

After two minutes, the drop of reagent is spread over the entire residue by means of a very finely-pointed glass rod, care being taken not to scratch the glass and to keep the rod in a continuous circular motion for 20—30 turns. After another two minutes, if arsenic is present, examination under the microscope (magnifying 40—50 or 100 diameters) reveals thick macles and crystallites, often arranged in a double fan-shape and coloured brownish-yellow, and groups of almost colourless tablets with rounded ends. When the residue is very small, only an extremely small drop (not more than 1—2 mm. diameter) must be used. The test can only be effected successfully by exact attention to all the above details. E. H.

Simplified Apparatus for the Estimation of Carbon in Iron. Theo. Grzeschik (*Chem. Zeit.*, 1908, **32**, 1092).—An improvement of the apparatus generally used. Close to the end of the inner tube of the condensing arrangement is sealed a concave disk, on which is placed the sample, and when the condenser is placed in the flask the disc should dip slightly into the chromic acid mixture. After transmitting a current of purified air and connecting the apparatus with the train of absorbers, heat is applied with a small flame, and, owing to the disc, a more even distribution of heat is effected. Instead of using a breakable glass tube for connecting the condenser with the water supply, an indiarubber tube is substituted. The distance between the condenser and flask is about 2 mm. The acid rises to a considerable height in the tube, but there is no danger of loss.

L. de K.

A Boat Funnel. H. Stoltzenberg (*Zeitsch. angew. Chem.*, 1908, **21**, 2271).—To facilitate filling the boat used for combustions, the author describes a nickel funnel made the shape and length of the boat and having a narrow slit underneath. This funnel is supported over the boat, which stands on a small nickel tray, and it allows of the substance being evenly distributed along the boat in an expeditious manner; if overfilled, the substance may be collected from the nickel tray. J. V. E.

Apparatus for the Estimation of Carbon Dioxide, etc. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 267—271).—The piece of apparatus described consists of a flat-bottomed flask provided with a hollow glass stopper, through the centre of which is fused the stem of a tapped funnel; the latter serves as a reservoir for the dilute acid, or other reagent, used in the estimation. A narrow glass tube extends from the stopper of the bottle to the top of the funnel, and a second tube leading from the stopper serves as the delivery tube of the apparatus. The top of the funnel is closed by means of a stopper provided with a small hole, which, on turning the stopper, is brought opposite a similar hole in the neck, so that the pressure in the flask may be equalised when necessary. The apparatus may be used for the estimation of carbon dioxide in carbonates, nitrogen in urea and ammonia (by using the sodium hypobromite method), and in the analysis of hydrogen peroxide, persulphates, etc. W. P. S.

Separation of the Alkali Metals in the Electrolytic Way. JACOB S. GOLDBAUM and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1908, **30**, 1705—1711).—In earlier papers (Abstr., 1907, ii, 574, 988), it has been shown that halide salts of various metals, and particularly those of the alkalis and alkaline earths, can be readily analysed electrolytically with the aid of a mercury cathode and a rotating silver anode. Results are now recorded which have been obtained with ammonium chloride, bromide, and thiocyanate, and the chlorides of cæsium, rubidium, lithium, and which prove the accuracy of the method.

An account is given of experiments on the separation of the alkali metals. Freudenberg (Abstr., 1893, ii, 506) has shown that trustworthy separations of metals may be obtained by arranging the pressure so that it exceeds the polarisation value of one metal and continues below that of the other. Working on this principle, separations of sodium from potassium, ammonium, cæsium, rubidium, and lithium, of potassium from rubidium, cæsium, and lithium, of cæsium from rubidium, and of lithium from rubidium and cæsium, have been successfully effected. The decomposition values of potassium and ammonium salts are so near to one another that these elements could not be separated.

It is suggested that this method of separation may prove useful in the estimation of small quantities of the alkali metals which occur in silicates. E. G.

Volumetric Alkalimetric Method for Determining Alkaline Earths in Manures and Soils. OTTO FOERSTER (*Landw. Versuchs-Stat.*, 1908, **69**, 235—243).—The substance (4—5 grams of quicklime or 8—10 grams of carbonate) is heated with *N*-hydrochloric acid (200—250 c.c.) in a 400 or 500 c.c. measuring flask for half an hour, then filled to the mark, and the whole filtered. A portion of the filtrate (100 c.c.), after adding the indicator, is treated with *N*/2 sodium hydroxide until the colour changes, then with 1—2 c.c. of *N*/2 acid, and boiled for a few minutes. When there is no, or only slight, precipitation of sesquioxides, the solution may be at once titrated back with *N*/2 alkali, and the number of c.c. used added to the number previously obtained. It is, however, usually advisable to dilute the cooled solution to 200 c.c. with water free from carbon dioxide and, after filtering, to titrate 100 c.c.

The approximate neutralisation of the acid solution is very desirable, as in this way most of the sesquioxides are separated. There must, however, always be an excess of acid so as to avoid the precipitation of calcium hydroxide.

It is pointed out that calcium silicates, owing to the readiness with which they are decomposed, are practically basic compounds. Calcium, in the form of hydrated silicate (or even after being ignited for half an hour), can be determined by the above method. N. H. J. M.

Volhard's Copper Titration. OTTO KUHN (*Chem. Zeit.*, 1908, **32**, 1056—1057).—The author agrees with Theodor (this vol., ii, 898) that Volhard's process gives very satisfactory results. He has, however, introduced a slight modification so as to avoid the harmful influence of free nitric acid, which has a solvent action on the copper thiocyanate precipitate.

The solution of the alloy in nitric acid is mixed with ammonia until a permanent precipitate has formed, which is then redissolved by adding a decided excess of sulphurous acid; the solution is then heated to boiling, and precipitated with ammonium thiocyanate, the excess of which is estimated in the filtrate with silver solution as usual. The nitric acid may, of course, be expelled completely by evaporating with sulphuric acid, but this would render the course somewhat more complicated. L. DE K.

Volumetric Estimation of Mercury by means of the Thiocyanate, Iodometric, and Acidimetric Processes. ERWIN RUPP (*Chem. Zeit.*, 1908, 32, 1077—1079).—*Thiocyanate Process.*—The solution, which must contain the mercury as mercuric nitrate or sulphate and be absolutely free from mercurous nitrate, also from chlorine and nitrous acid, is titrated with *N*/10 ammonium thiocyanate, using 2 c.c. of 10% iron-alum solution as indicator; 1 c.c. of thiocyanate = 0·01 gram of mercury. When the solution has been prepared by dissolving mercury in nitric acid, the oxidation is conveniently completed with potassium permanganate, the excess of which is then removed with a pinch of ferrous sulphate.

Iodometric Process.—Twenty-five to fifty c.c. of the solution, containing about 0·1—0·25 gram of the salt, are mixed in a stoppered flask with 1—2 grams of potassium iodide, 10—20 c.c. of 10% potassium hydroxide are added, and then 3 c.c. of 40% formaldehyde diluted with 10 c.c. of water. After shaking for two minutes, 10 c.c. of glacial acetic acid are added, and then 25 c.c. of *N*/10 iodine. When all traces of metallic mercury have disappeared, the excess of iodine is titrated with *N*/10 thiosulphate; no indicator is wanted. One c.c. of iodine solution = 0·01 gram of mercury.

Acidimetric Process.—This is based on the strong affinity of mercury for cyanogen. The mercury should be present as chloride, which may be effected, if necessary, by addition of 1 gram of potassium chloride; any free acid is carefully neutralised with potassium hydroxide, using phenolphthalein as indicator, and 20 c.c. of *N*/2 potassium cyanide are added. The excess of cyanide is then titrated with *N*/2 hydrochloric acid, using methyl-orange as indicator; 2 mols of cyanide = 1 at. of mercury. The titration may also be performed by simply adding the cyanide solution until the liquid turns pink.

Notwithstanding the great stability of the cyanide, it is completely decomposed by potassium iodide with formation of potassium cyanide, which may then be titrated with *N*/2 hydrochloric acid. Mercuric oxide may also be titrated with acid in presence of potassium iodide, from which it liberates the hydroxide. Instead of standardising the cyanide with *N*/2 acid, it may be also checked against a solution of mercuric chloride of known strength. L. DE K.

Volumetric Estimation of Mercuric Oxide. ERWIN RUPP and W. F. SCHIRMER (*Pharm. Zeit.*, 1908, 53, 928).—Mercuric oxide cannot be estimated by dissolving in hydrochloric acid and titrating the excess of this with alkali; but it may be titrated by dissolving about 0·25 gram in 10—20 c.c. of water containing 2—3 grams of potassium iodide, and titrating with *N*/10 hydrochloric acid, using methyl-orange as indicator. Heating on the water-bath promotes the solution of the oxide.

Another plan is to boil 0·25 gram of the oxide with 50 c.c. of water and 2 grams of mercuric cyanide. When all is dissolved, 1 gram of salt is added, and when cold the solution is titrated with *N*/10 hydrochloric acid, using methyl-orange as indicator.

The process may be employed for the testing of ointments. Two grams of the sample are boiled with 2 grams of mercuric cyanide and 50 c.c. of water until all the oxide has dissolved, 1 gram of salt is added, and the solution titrated with *N*/10 acid. On account of a slight saponification taking place, owing to the liberation of potassium hydroxide, the potassium iodide process is unsuitable for the testing of fatty ointments. L. DE K.

Estimation of Manganese by means of Potassium Ferricyanide. HERMANN BOLLENBACH and E. LUCHMANN (*Chem. Zeit.*, 1908, **32**, 1101—1102, 1114—1115).—The solution, which must be free from metals precipitable by hydrogen sulphide, and also from ferrous iron, cobalt, nickel, chromium, and reducing substances, is mixed with an excess of potassium ferricyanide. A decided excess of aqueous sodium hydroxide is added, and the manganese dioxide is collected and washed with hot water. The filtrate is acidified with excess of dilute sulphuric acid, and the potassium ferrocyanide formed in the reaction titrated with permanganate as usual. Two mols. of ferrocyanide = 1 at. of manganese.

In presence of ferrous iron, an aliquot part of the solution should be titrated with permanganate, and an allowance should be made.

L. DE K.

New Method of Attacking Ferro-compounds, particularly Ferro-silicon. PAUL NICOLARDOT (*Compt. rend.*, 1908, **147**, 676—678).—In decomposing ferro-silicon by chlorine at a red heat, it is impossible to retain all the silicon chloride. The author finds that ferro-silicon is completely decomposed by heating with commercial sulphur chloride at 70° for three minutes. Ferro-titanium is somewhat less easily decomposed, whilst ferro-chromium requires a temperature above 120°. The process is carried out in a 250 c.c. flask, closed by a small graduated dropping funnel of special shape. The apparatus is evacuated, and exactly 2 c.c. of sulphur chloride cautiously introduced. On completion of the action which is started by heating, a few drops of ammonia solution are introduced, and the flask is filled up with water as it gradually cools. The products are estimated in the usual way. R. J. C.

Separation of Tungstic Acid from Silica. PAUL NICOLARDOT (*Compt. rend.*, 1908, **147**, 795—797).—This separation is most readily effected by heating the mixture at 500° in a current of air charged with chloroform vapour, which, unlike carbon tetrachloride, does not give a deposit of carbon at this temperature. The tungsten is thus removed as a mixture of oxychlorides. W. O. W.

Reduction of Stannic Oxide. David B. Dott (*Pharm. J.*, 1908, 81, 585).—When stannic oxide (0·15 gram) is heated with hypophosphorous acid (0·5 gram) over a Bunsen flame during thirty minutes, it is converted into stannous phosphate or pyrophosphate, which is readily soluble in warm hydrochloric acid. Silica remains unaffected by this treatment, and, if present, can be filtered from the hydrochloric acid solution of the tin. T. A. H.

Physico-chemical Analysis of Mineral Water. Ernst Hintz and Leo Grünhut (*Zeitsch. angew. Chem.*, 1908, 21, 2359—2368. Compare *ibid.*, 1903, 16, 842).—A mathematical paper comprising a reply to Roloff's criticism of the formulæ used by the authors for calculating the middle dissociation value from the specific conductivity. The formulæ used by Roloff are deduced and shown to be only applicable in special cases, and a complete derivation of the authors' formula is given for the first time. Roloff's assumptions respecting the calculation of the freezing point are discussed, and examples given showing an error of + 5·8% from the observed values when use is made of his mode of calculation.

J. V. E.

Assay of Turpentine and Estimation of Mineral Oil in Rosin Spirit. R. Adan (*Bull. Soc. chim. Belg.*, 1908, 22, 389—396).—Herzfeld's sulphuric acid process is quite untrustworthy for the detection of petroleum products in turpentine or rosin spirit, but Burton's nitric acid method gives satisfactory results provided the temperature is lowered to − 10°. Some samples, although pure, may still give 1—2% of insoluble oils.

Petroleum in turpentine or rosin spirit may also be detected by collecting the distillate passing over between 120—150°. In the absence of petroleum, the fraction is miscible in all proportions with aniline or acetic anhydride.

Pure turpentine should practically distil over at 162°. In the case of rosin spirit, the bulk of the distillate collects between 165—175°, and the distillation is not quite finished even at 180°. This fact facilitates its detection in mixtures. It may be also identified by Grimaldi's test with tin and hydrochloric acid, which gives a green coloration, and also by its odour. L. de K.

Estimation of Essential Oils in Spices. R. Reich (*Zeitsch. Nahr. Genussm.*, 1908, 16, 497—509).—The method described by Mann (Abstr., 1902, ii, 432) gives trustworthy results if the point at which the solvent has been removed completely can be exactly determined, and for this purpose the author recommends the following modification as giving the best result. The solution of the ethereal oil in ether, or pentane, is placed in the evaporation flask, and the solvent is evaporated almost completely. A few drops of *iso*propyl chloride are then added to the flask, and the drying is continued until the current of air and other gases issuing from the platinum jet no longer gives a green flame when allowed to impinge against a heated copper gauze. The method is trustworthy for estimations of essential oils of cinnamon, cassia, cloves, peppermint, aniseed, thyme, ginger, and camphor, but cannot be used in the case of oils of carraway, lemon, eucalyptus, and turpentine, as these contain extremely volatile substances. W. P. S.

Detection of Small Quantities of Methyl Alcohol in the Presence of Ethyl Alcohol. LEONHARDT E. HINKEL (*Analyst*, 1908, **33**, 417—419).—The following method, in which the alcohols are oxidised to their corresponding aldehydes, and the formaldehyde then detected by means of morphine hydrochloride, is stated to be capable of detecting the presence of methyl alcohol in ethyl alcohol when the proportion of the former alcohol is not less than 5%. One c.c. of the mixed alcohols is placed in a small distilling flask, and the oxidising agent is added. If ammonium persulphate is used, 0·8 gram of the salt is added, followed by 3 c.c. of dilute sulphuric acid (1 : 5) ; or in the case of potassium dichromate, 1·5 grams of the salt and 1·5 grams of pure sulphuric acid are employed. In both cases, the mixture is diluted with water to 20 c.c. and distilled, the distillate being collected in test-tubes in five separate portions of 2 c.c. each. The first two portions, which will contain all the acetaldehyde, are rejected; to each of the remaining portions are added a few drops of 0·5% morphine hydrochloride solution, and concentrated sulphuric acid is run into each tube so as to form a layer at the bottom. In the presence of formaldehyde (resulting from the oxidation of the methyl alcohol), a violet ring will be formed at the junction of the two liquids. Pure ethyl alcohol always yields a trace of formaldehyde on oxidation, but the reaction obtained when 5% of methyl alcohol is present cannot be confused with the coloration due to the ethyl alcohol. W. P. S.

Apparatus for Polarising at 87°. ALBERT P. SY (*J. Amer. Chem. Soc.*, 1908, **30**, 1790—1791).—Apparatus is described for determining the rotatory power of sugar solutions at 87°. It consists essentially of a jacketed polariscope tube heated by means of a current of water from an instantaneous water heater. For details, the description and diagram in the original must be consulted.

E. G.

Influence of Clarification with Lead Acetate on the Estimation of Invert Sugar. O. SCHREFELD (*Zeitsch. Ver. deut. Zuckerind*, 1908, **634**, 947—956).—It has been shown by Prinsen-Geerligs (this vol., ii, 991) and others that, under certain conditions, lævulose and, in less degree, dextrose are partly precipitated from their aqueous solutions by basic lead acetate. The author has carried out experiments to ascertain whether the use of this reagent for clarifying solutions of commercial sugar products interferes with the estimation of invert sugar by the reduction of Fehling's solution.

The results show that the reducing power of invert sugar may be lowered by basic lead acetate, this being especially the case with low products and with high contents of invert sugar. When neutral lead acetate is employed, there is, however, little danger of low results being obtained. T. H. P.

Optically Active Non-saccharine Substances in Sugar Beet which are Eliminated by the Action of Lime in the Purification of the Sap, and their Polarimetric Estimation. Franz Herles (*Zeitsch. Zuckerind. Böhm.*, 1908, **33**, 94—98).—Polarimetric determinations in beet juice before and after boiling with lime generally resulted in lower figures after treatment with lime. The differences varied between 0·0% and 0·4%. Beet juice therefore contains, as a rule, some optically active non-sugar which is either precipitated or destroyed by the lime employed during the process of purification. N. H. J. M.

Colour Reactions of the Carbohydrates Based on the Formation of Furfuraldehyde from them. Reactions with Indole and Carbazole. C. Fleig (*J. Pharm. Chim.*, 1908, [vi], **28**, 385—392).—When 0·5 c.c. of a dilute solution of sucrose or other carbohydrate (many proteins also react) is treated with 3—4 c.c. of pure hydrochloric acid, the mixture boiled momentarily (if any coloration is thereby produced the carbohydrate solution should be diluted and less of it used), and 3—4 drops of a 0·1% alcoholic solution of indole added, a yellow-orange or reddish-orange coloration is produced. One to two drops of a 0·01% solution of sucrose diluted to 0·5 c.c. will give this reaction. Most of the sugars, starches, dextrins, glucosides, etc., react, but the polybasic alcohols, sorbitol, dulcitol, etc., are inactive. If sulphuric acid is used in place of hydrochloric acid, a blank experiment containing no carbohydrate must be made for comparison. The reaction with carbazole (which is given by the same substances as give the indole reaction) is obtained by adding 1—2 drops of a saturated alcoholic solution of carbazole and 1 c.c. of pure sulphuric acid to 0·5 c.c. of the carbohydrate solution, when a reddish-violet ring is formed at the junction of the two liquids. A blank experiment is necessary also in this case, since at certain temperatures carbazole and sulphuric acid react, giving red or violet colorations. E. H.

Polarimetric Estimation of Starch. Carl J. Lintner (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 509—512).—Sulphuric acid may be used in place of hydrochloric acid in the method described previously by the author (Abstr., 1907, ii, 823). 2·5 Grams of the finely-ground flour are mixed in a mortar with 10 c.c. of water and 20 c.c. of sulphuric acid, D 1·7 (77%); at the end of twenty-five minutes the mass is washed into a 100 c.c. flask by the aid of dilute sulphuric acid (1 : 3), 5 c.c. of 8% phosphotungstic acid solution are added, and the process then continued as described (*loc. cit.*). When sulphuric acid is used, barley starch has $[\alpha]_D^{20}$ 191·7°, and this value differs for each kind of starch. Unless the value be determined for each starch, the hydrochloric acid method is to be preferred, as, in this case, the value is fairly constant. W. P. S.

Estimation of Tartaric Acid in Wines by Evaporation. W. Mestrezat (*Ann. Chim. anal.*, 1908, **13**, 433—436).—The evaporation method proposed by Pasteur and modified by Reboul is considered to be more trustworthy than the official (French) method for the estimation of tartaric acid in wines. The following way of carrying out the estimation is recommended: 50 c.c. of the wine are evaporated to such an extent that the residue, when cold, is semifluid. After the lapse of five days, the crystals of potassium hydrogen tartrate which have formed are washed with 40% alcohol saturated previously with potassium hydrogen tartrate, and are then titrated in the usual manner. W. P. S.

Estimation of Malic Acid. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. Sucr. Dist.*, 1908, **26**, 266—267*).—It is pointed out by the author that the untrustworthiness of both the American official method and the process described by Cowles (Abstr., 1908, ii, 904) for the estimation of malic acid is mainly due to the use of precipitants which are insoluble in alcohol, and that, at the same time, calcium malate is appreciably soluble in 85% alcohol. Malic acid is best precipitated by means of a solution of barium bromide in 96% alcohol, the solution being rendered slightly ammoniacal before use, and the precipitation made in the presence of an excess of alcohol. W. P. S.

Detection of Benzoic Acid in Butter. Lucien Robin (*Ann. Chim. anal.*, 1908, **13**, 431—433).—The author modifies the method described by Halphen (Abstr., 1908, ii, 906) in order to prevent the formation of an emulsion when the butter is extracted. A portion of the butter is melted together with 50 c.c. of water, 15 c.c. of alcohol, and 0·5 gram of sodium hydrogen carbonate; the aqueous portion is then separated, acidified with sulphuric acid, heated, and filtered. The filtrate is shaken with ether, and the ethereal extract, after being washed with a mixture of 20 c.c. of water and 5 c.c. of alcohol, is shaken with 25 c.c. of the same water-alcohol mixture to which has been added 0·3 gram of sodium hydrogen carbonate. The aqueous portion, containing the benzoic acid as its sodium salt, is separated and evaporated to dryness; the residue is heated with 5 c.c. of sulphuric acid and 10 drops of fuming nitric acid until sulphuric acid fumes are given off, and the solution is then poured into 50 c.c. of cold water. After rendering the solution ammoniacal, a few drops of ammonium sulphide are added, when an orange-red coloration develops rapidly if the butter contains benzoic acid. W. P. S.

Colour Reactions of Aromatic Aldehydes with Phenols and Various Cyclic, Heterocyclic, and Open-chain Compounds. C. Fleig (*Bull. Soc. chim.*, 1908, [iv], **3**, 1038—1045).—When an acid is added to a solution of an aromatic aldehyde in alcohol also containing one of a variety of substances of which the following may be mentioned as types, phenol, gallic acid, camphor, menthol, aniline, pyrrole, indole, mercaptan, and *iso*butyl alcohol, a coloration, usually yellow, orange, red, or violet, or in some cases a

* and *Bull. Soc. chim. Belg.*, 1908, **22**, 413—414.

play of colours, is produced. The acid used may be sulphuric, hydrochloric, lactic, or a mixture of the last two. The colours given by menthol and terpin are similar to those yielded by cholesterols and biliary acids.

The aminophenols yield orange-red colorations, which turn yellow and finally disappear on addition of excess of acid. With alkalis they also change to yellow, but on the further addition of acid in excess become red. These changes are explained by assuming the existence in the solution of a tautomeric substance ***d***; this, on addition of sodium hydroxide, forms a product Na*d*, which is yellow in presence of excess of alkali and red in presence of excess of acid.

These colour reactions can be applied in the detection of free hydrochloric acid in gastric juice, and possibly to the detection of mineral acids in adulterated wines. T. A. H.

Colorimetric Estimation of Benzaldehyde in Almond Extracts. Alpheus G. Woodman and E. F. Lyford (*J. Amer. Chem. Soc.*, 1908, **30**, 1607—1611).—The reagents required are magenta decolorised by sulphurous acid and alcohol free from aldehyde. The former is prepared by dissolving 0·5 gram of magenta in 100 c.c. of water, and adding a solution containing 20 grams of sulphur dioxide. When decolorised, the solution is diluted to one litre. The alcohol is purified by distilling over silver oxide. To the distillate are added 25 grams of *m*-phenylenediamine hydrochloride per litre, a rapid current of air is drawn through the solution for three hours, and the alcohol is again distilled, the first 100 c.c. being rejected. The method as used with commercial almond extract may be outlined as follows:

Ten grams of the sample are diluted to 50 c.c. with the purified alcohol. Of this, 2 c.c. are placed in a Hehner cylinder and diluted with alcohol to 20 c.c. Three standard solutions are made up by diluting 2, 4, and 6 c.c. of benzaldehyde solution (alcohol containing 1 mg. of benzaldehyde per c.c.) to 20 c.c. and placing them in similar colorimeter tubes. The tubes are then placed for some time in water at 15°, and to the contents of each are added rapidly 20 c.c. of the magenta reagent, also at 15°. After ten minutes, the unknown sample is matched with the nearest standard in the usual manner by withdrawing part of either liquid. The depth of colour is proportional to the amount of benzaldehyde present. L. de K.

Detection of "Saccharin" (*o*-Benzoicsulphinide) and other Artificial Sweetening Materials in Beverages and Foods. Alberto Bianchi and Ettore Di Nola (*Boll. chim. farm.*, 1908, **47**, 599—605. Compare this vol., ii, 440).—The authors give the following modification of the method devised by Villiers and others (compare Abstr., 1904, ii, 599) for the detection of *o*-benzoicsulphinide in foods. The liquid, or, in the case of a solid, a suitable liquid extract, is freed from alcohol, heated to boiling, and acidified with about 20 drops of acetic acid per 100 c.c. The liquid is shaken, cooled, and mixed with about 10 c.c. of 20% lead acetate solution per 100 c.c. After half an hour, the excess of lead is precipitated by means of a solution containing 10% of sodium sulphate and 10% of sodium phosphate, double the volume of lead acetate used being always sufficient. The filtered liquid, concentrated to 70—80 c.c. if necessary, is acidified with 6—8 c.c. of dilute sulphuric acid (1 : 3), and shaken in a separating funnel with its own volume of a mixture of equal parts of ether and benzene. The benzene-ethereal extract is then slowly evaporated in a flat-bottomed glass dish. The residue is tested for (1) *o*-benzoicsulphinide by tasting, and by fusion with sodium hydroxide at 270°; (2) salicylic acid by extracting with a small quantity of alcohol, diluting the alcoholic solution, and adding ferric chloride. If salicylic acid is found, it must be destroyed before the residue is tested for *o*-benzoicsulphinide (compare Villiers, etc., Abstr., 1904, ii, 599).

The above method also serves for the detection of the ammonium ("sucramine"), sodium ("sucrose"), and magnesium derivatives of *o*-benzoicsulphinide, and of the so-called extract of sugar-cane, which is a solution of *o*-benzoicsulphinide in glycerol.

"Dulcine" or "sucrol" (*p*-phenetolcarbamide) may be detected by treating a small portion of the residue left by the benzene-ethereal extract (above) with silver nitrate (compare Ruggeri, *Ann. Lab. Centr. Gabelle*, **3**, 143). T. H. P.

Microchemical Studies. A. Bolland (*Monatsh.*, 1908, **29**, 965—994).—A paper dealing with the microchemical detection of the following substances: methylamine, dimethylamine, trimethylamine, ethylamine, diethylamine, triethylamine, propylamine, amylamine, hexylamine, neurine, ethylenediamine, pentamethylenediamine, choline, betaine, methylguanidine, α-aminovaleric acid, parvoline, pilocarpine, piperine, coniine, conhydrine, ψ-conhydrine, hyoscine, cornutine, ergotinine, colchicine, emetine, lobelliine, solanine, solanidine, chelidonine, chelerythrine, sanguinarine, strophantin, digitalin, picrotoxin, and santonin. The appearance, crystallographic and optical properties of the precipitates obtained on treating the tartrates of these substances with various reagents are described.

The refractive indices of the following alkaloids, determined by the immersion method, are given: solanine, solanidine, colchicine, conhydrine, ψ-conhydrine, and ergotinine; also of the tartrates of morphine, thebaine, quinine, cinchonidine, coniine, nicotine, hydrastine and cocaine. W. H. G.

Colour Reactions of Proteins. C. Fleig (*Ann. Chim. anal.*, 1908, **13**, 427—431).—The following colour reactions are given by the proteins which contain a carbohydrate group in their molecule, namely, ovalbumin, ovoglobulin, serum-albumin, and particularly the glucoproteins (mucin). The test is best carried out by mixing a few drops of a 20% solution of the reagent with a dilute solution of the protein and pouring the mixture on to the surface of a little concentrated sulphuric acid contained in a test-tube. Orcinol, catechol, pyrogallol, phenol, menthol, camphor, terpene, carbazole, thiophen, and pyrrole give red colorations; resorcinol and indole blue, and phloroglucinol, reddish-brown. W. P. S.

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1908.

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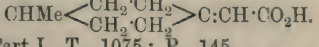

$$CHMe<\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}>C:CH\cdot CO_2H.$$

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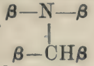
Senier, *Alfred*, and *Percy Corlett* **Austin**, attempted synthesis of  $\begin{array}{c}\beta\text{—N—}\beta\\ |\\ \beta\text{—CH}\beta\end{array}$ -dinaphthacridines; condensation of methylene dichloride and 1-substituted-2-naphthylamines, T., 63.

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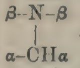

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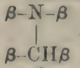

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- **Toluenediazonium** bromides. See Diazotoluene bromides.
- *p*-**Toluenehydrazoeugenyl** acetate (Auwers), A., i, 228.
- **Toluene-*p*-sulphinic acid**, preparation of (Knoevenagel and Kenner), A., i, 971.
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- **Toluene-2-sulphonanilide**, 4-nitro- (Ullmann and Gschwind), A., i, 623.
- **Toluene-*p*-sulphonic acid**, alkaloidal salts, and their rotatory power (Hilditch), T., 1621.

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p-**Toluic acid**, chloroimino-, chloroimino-2-nitro-, and imino-2-nitro-, isomeric esters of (Hilpert), A., i, 830.

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o-**Toluidine**, 4-nitro-, hydrochloride of (Willgerodt and Kok), A., i, 620.

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o-**Tolyl** β-bromoethyl ether (Gattermann), A., i, 32.

  trimethylene ether, and its di-4-4′-aldehyde (Gattermann), A., i, 34.

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β-*p*-**Tolylbenzylhydrazine** and its hydrochloride and benzoyl derivative (Schlenk), A., i, 738.

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p-**Tolyl-ψ-benzylthiocarbamide**, cyano- (Fromm and Weller), A., i, 703.

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p-**Tolylcarbamide**, 2-iodo-, and its *N*-nitroso-derivative (Willgerodt and Gartner), A., i, 876.

o-**Tolyl chloromethyl ketone**, 5-chloro- (3-*chloro*-6-*chloroacetyltoluene*) (Kunckell), A., i, 729.

N-**Tolyldiacetonitriles**, *o*-, *m*-, and *p*- (v. Meyer and Schumacher), A., i, 909.

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β-*p*-**Tolylglutaric acid**, nitration of, and its 3-nitro-5-amino-derivative (Avery and Upson), A., i, 796.

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3-*p*-**Tolylhydantoic acid** and its ethyl ester (Bailey and Randolph), A., i, 741.

o-**Tolylideneacetone** (Meerwein), A., i, 90.

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o-**Tolylidenemalonic acid**, methyl ester (Meerwein), A., i, 90.

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1-*o*-**Tolyl-2-methylbenziminazole**, 4:7-*di*nitro-6-hydroxy-, and its silver salt, acetyl derivative, and ethyl ether (Meldola and Hay), T., 1672.

1-*p*-**Tolyl-2-methylbenziminazole**, 4:7-*di*nitro-6-hydroxy-, and its salts and ethyl ether (Meldola and Hay), T., 1673.

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p-**Tolylmethylcyanamide** (v. Braun), A., i, 626.

o-**Tolyl**-*o*-**methylimesatin** (v. Ostromisslensky), A., i, 82.

p-**Tolyl**-*p*-**methylimesatin** (v. Ostromisslensky), A., i, 889.

1-*p*-**Tolyl-3-methylpyrazole-5-sulphonic acid** and its derivatives (Michaelis and Dulk), A., i, 692.

1-*p*-**Tolyl-3-methylpyrazolone**, 5-thio-, and its derivatives (Michaelis and Dulk), A., i, 691.

2-*p*-**Tolyl-4-methylpyrimidine**, 6-amino-, 6-chloro-, 6-thio-, 6-thiocyano-, and 6-thiocarbimido-derivative (Johnson, Storey, and McCollum), A., i, 838.

b-*p*-**Tolyl**-*a*-*a*-**naphthylcarbamide**, *a*-hydroxy- (Scheiber and Beckmann), A., i, 725.

o-**Tolylnitrosoamine**, *N*-benzoyl derivative (Jacobson and Huber), A., i, 299.

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β-*p*-**Tolylpropionic acid**, β-hydroxy-, synthesis of, and its ethyl ester and salts (Andriewsky), A., i, 799.

3-*m*-**Tolylrhodanic acid** and its condensation with aldehydes (Andreasch), A., i, 683.

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p-**Tolylthiolacetic acid**, preparation of (Kalle & Co.), A., i, 605.

p-**Tolylthiopyrine** (Michaelis and Dulk), A., i, 691.

p-**Tolylthiuret**, action of aromatic amines and hydrazines on (Fromm and Weller), A., i, 701.

2-**Tolyl**-*o*-**tolyliodonium** salts, 4-nitro- (Willgerodt and Kok), A., i, 620.

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γ-Triazopropane, αβ-*di*bromo- (Forster and Fierz), T., 1178.

α-Triazopropionic acid and its ethyl ester, silver salt, and amide (Forster and Fierz), T., 671; P., 54.
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  detection of nitrates in (MARSIGLIA), A., ii, 894.
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  new method of estimating the fixed and volatile acids in (POZZI-ESCOT), A., ii, 904.
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  estimation of alcohol in (DUBOUX and DUTOIT), A., ii, 136.
  estimation of esters in (AUSTERWEIL and PACOTTET), A., ii, 232.
  estimation of sulphur dioxide in (MENSIO), A., ii, 63.
  estimation of tannins in white (KOEBNER), A., ii, 240.
  estimation of tartaric acid in, by evaporation (MESTREZAT), A., ii, 1078.
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Wine lees, estimation of tartaric acid in (POZZI-ESCOT), A., ii, 740.
Witherite, specific heat of (LATSCHENKO), A., ii, 758.
Witte's peptone. See Peptone.
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Wood, investigations on the charring of (KLASON, V. HEIDENSTAM, and NORLIN), A., i, 717, 955.

(o-*Xylene, Me* : *Me*=1:2; m-*xylene, Me* : *Me*=1:3; p-*xylene, Me*: *Me*=1:4.)

Wood oil, Japanese (Kametaka), A., i, 850.

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X-rays. See Röntgen rays under Photochemistry.

Xanthen, action of benzoyl chloride on (Heller and v. Kostanecki), A., i, 445.

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Xanthine as a cause of fever (Mandel), A., ii, 54.

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Xanthyl derivatives, new (Silberrad and Roy), P., 204.

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  density of (Moore), T., 2181; P., 272.

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o-**Xylene**, nitro-derivatives of (Crossley and Renouf), P., 58.
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m-**Xylene**, reaction of, with ethyl diazoacetate (Buchner and Delbrück), A., i, 87.

m-**Xylene**, *ω*-*tetra*chloro- (Bielecki), A., i, 424.

p-**Xylene** *di*sulphoxide (Knoevenagel and Polack), A., i, 971.

p-**Xylene**, *ω*-*di*nitro-, diazobenzene derivative of (Ponzio and Charrier), A., i, 582.

m-**Xylene-4′-azo-3-cyano-** and **-3-carboxy-*β*-naphthol-6-sulphonic acids**, sodium salts (Lange), A., i, 300.

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m-**Xylene-4-azoresorcinol**, 5-bromo- (Orton and Everatt), T., 1019.

Xyleneazo-. See also Xylylazo-.

p-**Xylene-2-sulphinic acid**, alkaloidal salts, and their rotatory power (Hilditch), T., 1621.

Xylenesulphinic acids, *o*-, *m*-, and *p*-, preparation of (Knoevenagel and Kenner), A., i, 971.

p-**Xylenesulphinic anhydride**, preparation of (Knoevenagel and Polack), A., i, 971.

m-**Xylene-4-sulphonic acid**, 2:6-*di*nitro-, derivatives of (Karslake and Morgan), A., i, 410.

p-**Xylene-2-sulphonic acid**, alkaloidal salts, and their rotatory power (Hilditch), T., 1621.

m-**2-Xylenol** and its bromo-, bromonitro-, bromonitroso-, nitro-, and nitroso-derivatives, and its methyl ether (Auwers and v. Markovits), A., i, 629.
  methyl and ethyl ethers (Gattermann), A., i, 33.

m-**5-Xylenol** methyl ether, sulphination of (Smiles and Le Rossignol), T., 761.
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p-**Xylenol** ethylene ether and its dialdehyde (Gattermann), A., i, 35.

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m-**Xylidine**, acetyl derivative. See Aceto-*m*-xylidide.

m-**Xylidine**, *tri*chloro- (Mannino and di Donato), A., i, 826.

Xylidines, action of dichloroacetic acid on (Heller and Leyden), A., i, 218.

3-*as*-*m*-Xylidino-5:7-dimethyloxindole and its bromo-derivative and **3′:5′-Xylidino-4:6-dimethyloxindole** (Heller and Leyden), A., i, 218.

p-**Xyloquinone**, *di*hydroxy-, diacetate of (Fichter and Weiss), A., i, 659.

Xylose derivatives, synthesis of (Ryan and Ebrill), A., i, 716.

Xylose-*m*-nitrophenylhydrazone (Reclaire), A., i, 1014.

Xylylaldehyde and its derivatives (Savariau), A., i, 189.

as-*m*-**Xylylaniline**, *o*-hydroxy-, and its *N*-acetyl derivative (Anselmino), A., i, 259.

m-**Xylylazoacetoacetic acid**, ethyl ester, and its benzoylhydrazone (Bülow and Schaub), A., i, 705.

o-*Xylene*, *Me* : *Me*=1:2; m-*xylene*, *Me* : *Me*=1:3; p-*xylene*, *Me* : *Me*=1:4.)

- **Xylylazo-**. See also Xyleneazo-.
- α-**Xylylethyl** alcohol, βββ-*tri*chloro- (SAVARIAU), A., i, 188.
- *v*-*m*-**Xylylnitrosoamine**, *N*-acetyl derivative, and its compound with alcoholic α-naphthol (JACOBSON and HUBER), A., i, 299.

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  - behaviour of cultivated varieties of, in composite nutrient solutions (HENNEBERG), A., ii, 416.
  - can betaine be regarded as a source of nitrogen for? (STANĚK and MIŠKOVSKÝ), A., ii, 416.
  - formation of glycogen by (PAVY and BYWATERS), A., ii, 56.
  - sugar formation and other fermentative processes in (SALKOWSKI), A., ii, 215.
  - beer, action of, on acid amides (EFFRONT), A., i, 491.
  - expressed, co-enzyme of, in juice (BUCHNER and KLATTE), A., i, 380.
- **Yeast cellulose**, yeast dextrose, and yeast gum (MEIGEN and SPRENG), A., ii, 315.
- **Yeast juice**, properties of (BUCHNER and KLATTE), A., i, 589.
  - action of the electric current on (RESENSCHECK), A., i, 491.
  - the alcoholic ferment of (HARDEN and YOUNG), A., i, 590.
- **Yeast press juice**, sensitising action of fluorescent substances in (v. TAPPEINER, KURZMANN, and LOCHER), A., i, 239.
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- **Yerba Buena**. See *Micromeria Chamissonis*.
- **Ylang-ylang oil** (BACON), A., i, 815.
- **Yohimbine**, physiological actions of (GUNN; TAIT and GUNN), A., ii, 412.
- **Ytterbium**, resolution of, into its components (v. WELSBACH), A., ii, 591; (URBAIN), A., ii, 849.
- **Yttrium**, phenomenon attributable to positive electrons in the spark spectra of (BECQUEREL), A., ii, 334.
- **Yttrium** hydroxide, heterogeneous colloidal (SZILÁRD), A., ii, 197.
- **Yttrium earths** (LENHER and BENNER), A., ii, 385.
  - new method for the separation of (JAMES), A., ii, 190.
  - See Cerium metals and Earths, rare.

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- **Zinc**, electrolytic valve action of (SCHULZE), A., ii, 560.
  - heating effects produced by Röntgen rays in (BUMSTEAD), A., ii, 342.
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  - favourable influence of small quantities of, in the growth of *Sterigmatocystis nigra* (JAVILLIER), A., ii, 124.
- **Zinc alloys** with aluminium, hardness of (SAPOSHNIKOFF), A., ii, 284.
  - with calcium (DOŃSKI), A., ii, 278.
  - with cobalt (LEWKONJA), A., ii, 853.
  - with copper, action of oxygen on (JORDIS and ROSENHAUPT), A., ii, 107.
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- **Zinc salts**, abnormal behaviour of, on hydrolysis (DENHAM), A., ii, 380.
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- **Zinc bromide and chloride**, double, with the alkalis (EPHRAIM), A., ii, 693.
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  - carbonates, basic (MIKUSCH), A., ii, 185.

Zinc ammonium chromates (Gröger), A., ii, 691.
  hyposulphite, dry, direct production of (Chemische Fabrik Grünau, Landshoff, & Meyer), A., ii, 185.
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  sulphate, electrical conductivity in systems containing ammonia, water, and (Shumakoff), A., ii, 457.
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Zinc organic compounds, mixed, synthesis with (Blaise), A., i, 78; (Blaise and Herman), A., i, 248.
  Zinc allyl iodide, action of, on the anhydrides of monobasic acids (Saytzeff), A., i, 73.
    mercuric cyanide, formula of (Dunstan), P., 135.
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  *tetra*fluoride, preparation and properties of (Wolter), A., ii, 701.
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Zirconium and titanium, simultaneous precipitation of, in presence of iron (Dittrich and Freund), A., ii, 134.
  separation of, from titanium (Dittrich and Freund), A., ii, 134.
  separation of thorium, titanium, and, from iron (Dittrich and Freund), A., ii, 135.
Zirconium minerals, radioactive, argon in (v. Antropoff), A., ii, 943.
Zymase, formation of, in yeast (Buchner and Klatte), A., i, 589.

ERRATA.

Collective Index, 1873—1882 (Authors).

Page	Line	
259	11	col. i *for* "773" *read* "173."

Vol. LXX (Abstr., 1896).

Part I.

33	9	*for* "COOEt·C(OH)(CO·NHPh)·C(OH)(CO·NHPh)·COOEt" *read* "COOEt·CH(O·CO·NHPh)·CH(O·CO·NHPh)·COOEt."

Vol. LXXIV (Abstr., 1898).

Part I.

477	1	*for* "Methoxytolualdehyde" *read* "Ethoxytolualdehyde."
477	2	*delete* "whilst the isomeride."
477	3	*for* ":OEt" *read* ":OMe."
477	3	*delete* "third."
477	4	*for* "OEt" *read* "OMe."

Collective Index, 1893—1902.

Part II (Subjects).

667	17	col. ii *insert* "**Ethoxytolualdehyde** (Gattermann and Frenzel), 1898, i, 477."
1001	5	,, ii *for* "phenyltoluidine" *read* "phenyltolylamine."
1257	24	,, i *delete* "See also Methyldiphenylamine."

Vol. LXXXVIII (Abstr., 1905).

Part I.

336	12	*for* "arylsulphonates" *read* "arylsulphinates."
337	20	

Part II

755	5*, 7*, 9*, 11*, 19*	*for* "rice" *read* "rye."

Vol. XC (Abstr., 1906).

Part I.

640	9*	*for* "Georg" *read* "Wilhelm."
641	1	

Part II.

547	12*	*for* "the sulphide" *read* "iron."
973	17	col. i *for* "Georg" *read* "Wilhelm."
973	20	,, i

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* From bottom.

ERRATA (*continued*).

VOL. XCII (ABSTR., 1907).

PART I.

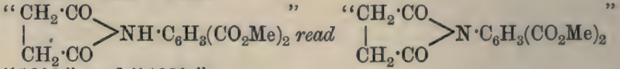
Page	Line	
137	1	*for* “2-Nitro*iso*phthalic acid” *read* “2-*Nitro*iso*phthalic acid.*”
233	16	,, “phenylrhodanic” *read* “anilinorhodanic.”
509	9	,, “hexahydro-*m*-toluic acid” *read* “1-methyl*cyclo*hexane-2-carboxylic acid.”

PART II (INDEX).

1009	19*	col. ii	*for* “662” *read* “622.”
1059	10	,, i	,, “**Köffler**” *read* “**Löffler.**”
1068	10*	,, i	*insert* “an attempt to synthesise collidine, A., i, 440.”
1074	2	,, ii	*for* “**Mayer**” *read* “**Meyer.**”
1076	10	,, ii	*insert* “reversible reactions of the first order, A., ii, 753.”

VOL. XCIV (ABSTR., 1908).

PART I.

44	5*	*for* “$C_{15}H_{26}N_2,MeI_3HI,H_2O$” *read* “$C_{15}H_{26}N_2MeI,HI,H_2O$.”
249	5	,, “$CMe_2\cdot CO\cdot CMe{:}CH_2$” *read* “$CHMe_2\cdot CO\cdot CMe{:}CH_2$.”
266	19*	,, “*diethylaminoethyl*” read “*diethylaminopropyl.*”
275	8*	,, “2-Phenylpyrrolidine” *read* “2-Phenylpyrroline.”
288	13, 14	,, “3-*phenyl*-1-*methyl*-2-*quinoline*” read “3-*phenyl*-1-*methyl*-2-*quinolone.*”
345	16*	,, “GIALDINO” *read* “GIALDINI.”
406	11*	,, “1-iso*propylhexane*-2-*one*” *read* “1-iso*propyl*cyclo*hexane*-2-*one.*”
408	21	,, “ROELKER” *read* “ROLKER.”
457	20*	,, “4-*nitro*-4-*hydroxydiphenylamine*” read “4-*nitro*-4′-*hydroxydiphenylamine.*”
474	4	,, “aminophenylthiocarbamide” *read* “aminophenylcarbamide.”
494	10*	,, “HCl_2Cl” *read* “$CHClI_2$.”
590	6*	,, “$NMe_2\cdot C_6H_4\cdot As(OH)\cdot ONa$” *read* “$NMe_2\cdot C_6H_4\cdot AsO(OH)\cdot ONa$.”
591	20, 21	,, “crystallising” *read* “the *sodium* salt crystallises.”
591	5*	,, “KUHN” *read* “KAHN.”
652	21	,,  “$\begin{array}{l}CH_2\cdot CO\\ \vert\\ CH_2\cdot CO\end{array}\!>NH\cdot C_6H_3(CO_2Me)_2$” *read* “$\begin{array}{l}CH_2\cdot CO\\ \vert\\ CH_2\cdot CO\end{array}\!>N\cdot C_6H_3(CO_2Me)_2$”
687	4	,, “1899” *read* “1889.”
692	21*	,, “VIII” *read* “XXIX.”
765	17	*delete* “FUNIA.”
773	7*	*for* “*α-Bromo*iso*hexyl-β-aminobutyric acid*” read “*α-Bromo*iso*hexoyl-β-aminobutyric acid.*”
809	1*	,, “*dl*-fenchene” *read* “*D-l*-fenchene.”
810	13	
810	17	
810	23	
811	1	
810	4	,, “*dl*-hydroxyfenchenic acid” *read* “*D-l*-hydroxyfenchenic acid.”
810	5	
810	9	
811	6	
810	12*	,, “*dd*-fenchene” *read* “*Dd*-fenchene.”
927	1, 2, 3	*should read* “p-*Nitrobenzeneazosalicylic acid*, m. p. 256°; the constitution is proved by its yielding aminosalicylic acid and *p*-phenylenediamine when reduced by sodium hyposulphite in hot aqueous solution.”
927	13	*for* “hydrogen” *read* “hypo-.”

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* From bottom.

ERRATA (*continued*)

Page	Line	
927	21, 22	*for* "diaminodiphenyl derivative of carbamide" *read* "diaminodiphenylcarbamide derivative."
927	24	*before* "*p*-aminophenol" *insert* "diazotised."
927	25	,, "aminosalicylic acid" *insert* "diazotised."
931	22	*for* "X" *read* "XXXIV."
1017	19	,, "not" *read* "now."

Part II.

24	9	*for* "Guillaume Schæffer" *read* "Georges Schæffer."
118	19*	,, "Baylis" *read* "Bayliss."
124	21	,, "190" *read* "1907."
234	12	,, "**Titration of Formaldehyde**" *read* "**Formaldehyde-titration.**"
234	14, 15	,, "Formaldehyde may be titrated with alkali and phenolphthalein as indicator" *read* "Sörensen's so-called 'formaldehyde-titration' (this vol., i, 115) may be carried out."
234	27	,, "usual titration" *read* "formaldehyde-titration"
393	8*	,, "C. S." *read* "G. S."
421	11*	,, "*J. Landw.*" read "*J. exper. Landw.*"
422	19*	,, "one inch" *read* "nine inches."
464	16	,, "517" *read* "644."
719	11*–6*	The statement and criticism are wrongly attributed. The statement is by Knoop, the criticism by Friedmann.
743	2*	*for* "1908" *read* "1898."
1058	2*	,, "Allaret" *read* "Allard."

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